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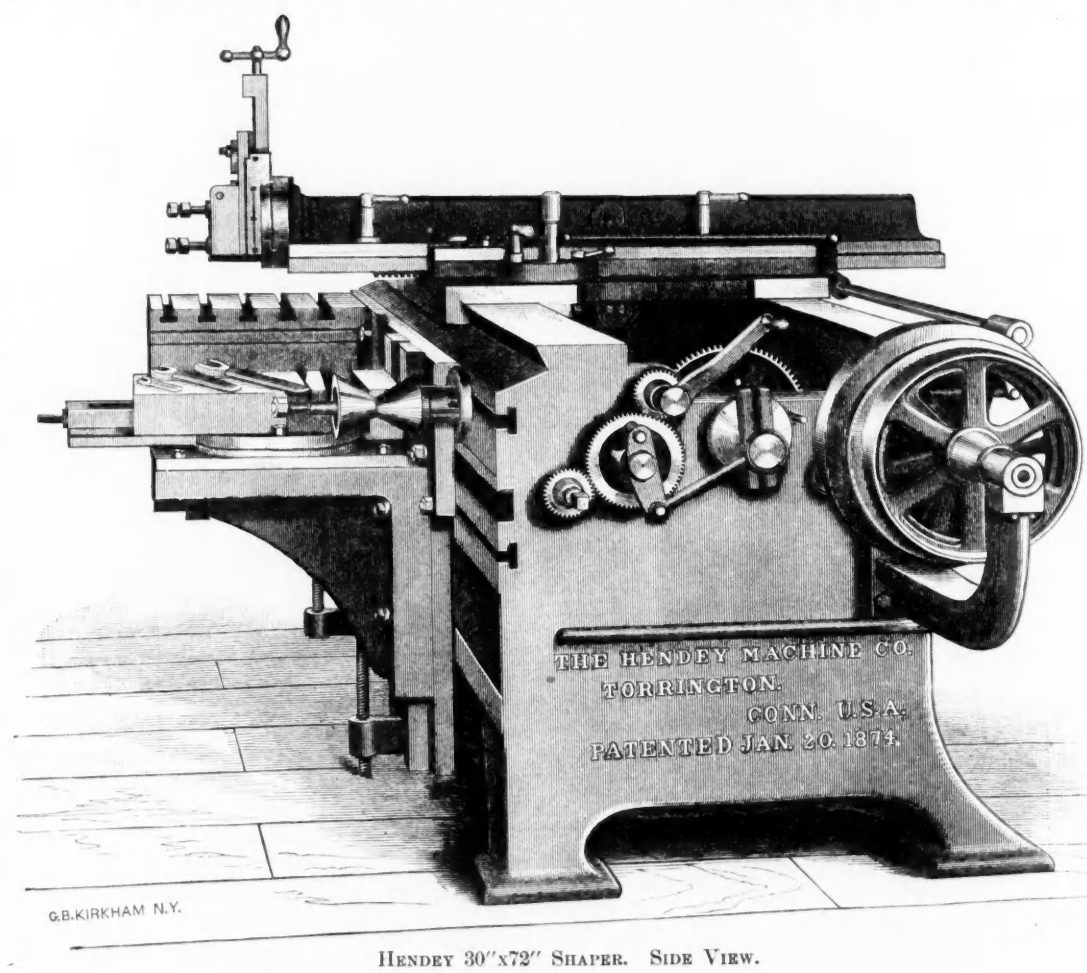
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Hendey 30″x72″ Shaper.

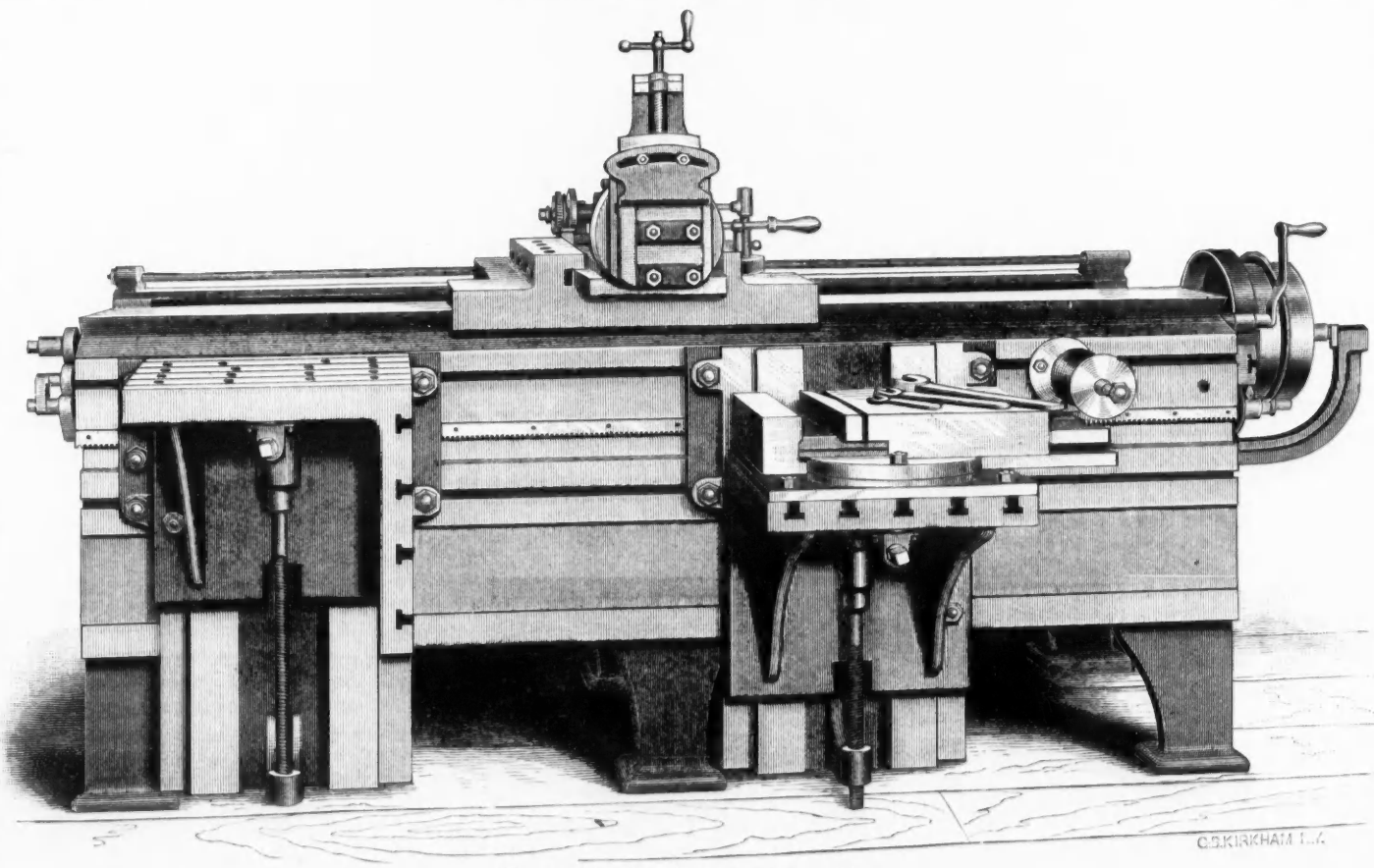
This shaper, of which two perspective views are shown on this page, is designed for railroad and other heavy work. It has a stroke of 30″, and can be set to any length of stroke from 1″ to 30″, while the machine is in motion, thereby making a saving in time over the crank shaper. The saddle has a traverse on the bed of 72″, but the machine can be made of any length desired to suit special work. The machine has feed-works on each end to feed the saddle back and forth, so that in using the tool on one end or the other the feed is always convenient to hand. The saddle can be run fast by hand from one end to the other when desired to change its position on bed, each turn of crank moving it 2⅜″. It also has an adjusting handle on the saddle to use in setting tool close to work when starting the machine.

The head has automatic vertical feed, and can be set to any angle. The circular arbor also has independent feed, and is operated from the pulley end of machine. The tables are raised and lowered by screws, and the aprons on which the tables work are moved on bed by rack and pinion. The aprons have a bearing low down on the bed to insure solidity when taking a heavy cut. The vise jaws open 15″, and are 15″ long; vise is graduated, and swivels on a heavy base plate. The vise is operated by one screw, 1¼″ diameter. The vise is also provided with extra jaws to hold taper work, and eye-bolt to lift it off by tackle, as the weight (500 lbs.) is too much to lift by hand. The screws and shafts are all of steel, and bearings are of hard bronze. The rack gear and pinion, and other small gears, are of steel. Nuts and screw-heads liable to abrasion are case hardened; all sliding surfaces accurately scraped. The machine should stand on a brick or stone foundation, and for large work, which is to be worked from the floor, the manufacturers can provide heavy cross beams to stand the machine on, and a heavy cast-iron table, with slots and holes like planer table, to bolt work to.

From the top of this table to slide is 44″. The tables on machine can be run off easily to make room for large work, and work can be bolted to front of machine. Weight of machine, without foundation, beams and plate, 10,000 lbs. The machine is made by the Hendey Machine Company, Torrington, Conn.



HENDEY 30″x72″ SHAPER. SIDE VIEW.



HENDEY 30″x72″ SHAPER. FRONT VIEW.

When a machine shop or ordinary business establishment, which for years has been doing a good business, falls into financial difficulties and finally becomes bankrupt under an insupportable load of debt, the conclusion arrived at by a discriminating public is, that the business management has been incompetent. If we are to judge from the tone of comments made by the railroad press over a conspicuous case of railroad failure, railroad management is not to be judged by ordinary business standards. Six years ago the New York, Lake Erie & Western Railroad Company was formed from the wreck of the Erie, and placed under what was regarded as the ablest management of the country. Hugh J. Jewett, President, and George R. Blanchard, his assistant, now retire, leaving the road in a semi-insolvent condition, and their departure from the management has called forth enthusiastic testimonials regarding their executive ability from most of our railroad exchanges. These gentlemen may have abilities of a high order for executive work, but the unfortunate Erie does not bear prominent traces of their transcendent skill in management. The foundation on which the prosperity of a railroad rests is a good track, operated with good rolling stock. The management of the Erie did not appear to descend into practical details which should keep supervision over rolling stock and machinery, if we are to judge by the condition of that part of the property, for it is in worse shape than the rolling stock and machinery of any other prominent northern railroad that has come under our observation.

Hadfield's Patent Manganese Steel.

The patent manganese steel of the Hadfield Steel Foundry Company, Sheffield, is coming into favor amongst machinists wherever it has been tried, and it is remarkable, to say the least, that an ingredient which many metallurgists considered would render steel rotten and worthless if in excess of 1½ per cent., should have been found so valuable in proportions ranging from 7 to 30 per cent. In the process of manufacture melted ferro-manganese is added to iron that has been nearly or quite decarbonized or to molten steel; it is thoroughly incorporated by stirring, and is poured into ingots or other moulds. The percentage of ferro-manganese varies with the purpose to which the steel is to be put. No absolutely exact proportions can be given. To produce a steel suitable for armor, sufficient ferro-manganese to give, say, 10 per cent. manganese in the steel, should be added; for car wheels, axles, or railway plant, say, 11 per cent.; edge tools and steel toys, 12 per cent. With proper care in moulding and manufacture, articles can be made as smooth and clean as with cast iron. Some of the most valuable characteristics of this steel are shown in casting. It possesses great thinness and fluidity, casts without misrunning, does not settle as much as ordinary castings, and does not draw, particularly at the junction of the thick and thin parts. It is also free from honeycomb and other similar defects.

It is evident that a metal that casts in this manner, and that needs no hardening or tempering, must be especially adapted not only to the manufacture of most articles that are now cast, but for a wide range of articles that are now forged, rolled, or hammered, such as the larger edged tools, hammers, picks, etc., guns, armor plate, shell, and other projectiles, car wheels in place of chilled wheels, implements, and parts of machinery, especially bearing parts, safes, steel toys, plow steel, etc. A razor has been cast from this steel, and used without hardening. It was not equal to the best steel razor, but it was a fair implement.

Perhaps the most remarkable and valuable of the properties of Hadfield's steel is its great toughness, combined with its extreme hardness—two properties that are generally regarded as incompatible. One of the most remarkable properties of this steel exhibits itself in connection with hammering or drawing it. When thus manipulated, it becomes exceedingly hard and loses some of its toughness. It is then raised to a yellow or nearly welding heat, and allowed to cool in the air, or cooled in water or oil, it becomes exceedingly tough. In bulk, the steel is non-magnetic, and is a poor conductor of electricity; but fine drillings or scrapings are attracted by a magnet.—*English Mechanic and World of Science.*

Nicholson's Expanding Lathe Mandrel.

Fig. 1 is a sectional view of the mandrel as fitted for holding an eccentric, the throw being made on the jaws, and is used for small work. Fig. 2 is an end view of the same. Fig. 3 is an end view of the mandrel with the parallel jaws, which are used for the general class of work. Fig. 4 is the mandrel with a step form of segments, used for work of narrow bore, such as collars, etc., and gives more variety of sizes.

This mandrel consists of a plain, tapered, steel arbor, with hardened ends, and four steel jaws, which are fitted through slots in a sleeve (as shown in engraving) to keep them in position. These jaws are concaved on their inner edges, so as to have a good bearing on the mandrel, and are turned on their outer edges while on the mandrel they are to be used, thus making them perfectly true with it.

The power of holding which this mandrel possesses is claimed to be thorough, having been tested on large work and heavy cuts.

A set, consisting of eight of these mandrels, with three sets of jaws (as shown in Fig. 3) to each, takes any $\frac{1}{100}$ part of an inch from one inch to seven inches.

This set of mandrels is designed to suit the general class of work in a machine shop, but is made for special purposes as well.

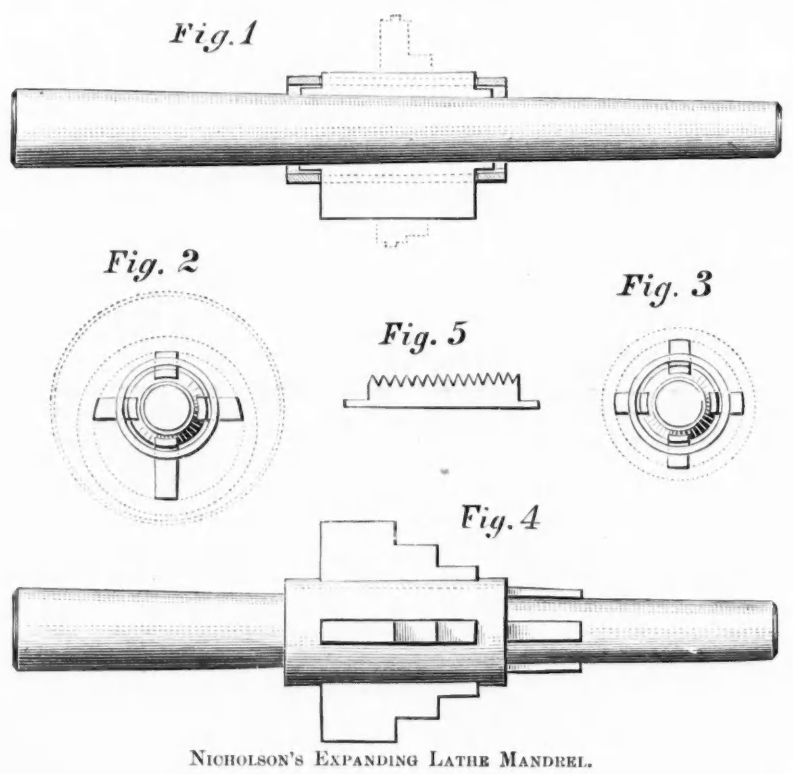
The inventor is W. H. Nicholson, and they are manufactured by W. H. Nicholson & Co., Wilkes Barre, Pa.

For Steam Users.

SUGGESTIONS IN REGARD TO INSURING THE SAFETY OF THEIR STEAM BOILERS.

By George Marshall.

In addition to what has already been presented, attention should be given to the proper position of the feed-pipe, as in many cases the introduction of the feed-water at a lower temperature than that contained in the boiler has been the cause of serious injury, from the fact that the feed-water, coming in direct contact with the heated metal, has caused a contraction of the latter, in time resulting in fracture, which could be avoided were proper precautions taken when the pipes were put in position. It is a common practice to intrust the arrangement of all piping to the workman who puts the engine together in the shop, without any thought as to his ability or experience in work of this kind to insure the safest and best results. Improper pipe connections often lead to incalculable injury to the boiler by reason of undue expansion, yet comparatively few of our pipe-fitters thoroughly understand this very important branch of their business.



Nicholson's Expanding Lathe Mandrel.

The causes which lead to incrustation in a boiler have already been referred to. The causes which lead to corrosion, notwithstanding the attention this subject has received, are as yet but very imperfectly understood, and it is not an infrequent occurrence to have two or more boilers running side by side, fed from the same supply, in one of which the seams will first show a weakness from this cause, while in others it may be the braces or the center of the plate at, above or below the water line. In boilers of the locomotive type the favorite part for corrosive action seems to be the threaded braces or stay-bolts. That this may be, and no doubt, is caused by the outer surface of the iron being cut away in the thread-cutting process, is, to my mind, an undeniable fact; yet it has been noticed that turned pieces of bar iron intentionally or accidentally left in some boilers of this type will withstand corrosive action, while the stay-bolts at the thread will be badly eaten away. Corrosive action may be caused by the introduction into a hot boiler of the feed water at a much lower temperature. This is a mechanical corrosion due to the sudden contraction of the metal by impact of the cold water, and a corresponding expansion when uniformity of temperature is restored. Rivet heads are frequently attacked by corrosion, while no other part of the boiler is similarly affected, and in cases of this kind the action of the corrosive agents, being enshrouded in a seeming mystery, frequent internal examinations should be resorted to and thoroughly performed to insure the strength of boiler being maintained to perform its daily duty. The tubes in sound boilers are pitted or honeycombed, as it is commonly called, while all other parts of boilers are entirely free from this defect, and in repair shops it is often a cause of surprise to the workman whose duty it is to clean the incrustation from tubes, prior to their piecing and returning to boiler, to find that many of them, although presenting an appearance of uniformity, as far as the incrustation is concerned, on removal of the latter, are, in many instances, eaten through, and consequently unfit for use. Corrosion and incrustation vary according to locality, not so much the latter as it is the impurities found in the waters of different localities. In some cases, and at trifling expense, a change from the water commonly used to an adjacent supply would result beneficially, and prevent the deterioration of boilers. An analysis in all cases would demonstrate beyond question which water was best for steam purposes. It is needless to add that analysis is never had until one or more boilers have been permanently injured, and injured beyond repair. Galvanic and voltaic action have been charged with corrosion and pitting when brass or copper has entered into the construction of the boiler of iron, yet, in the writer's experience, as great injury has been done from this cause where iron alone was the material employed. It has been recommended by some authorities to abandon the water supply where corrosion was found to take place. This is not always practicable, unless resource is had to the sinking of a well, the expense of which, in connection with the uncertainty of procuring a better supply, deters many from resorting to this protective measure. Attention and care in examinations will greatly add to the safety and durability of boilers when this step is followed, and perhaps a study of the water supply and the understanding of the solids held in solution in the water of different localities may lead, in many cases, to the prevention of further injury. In addition to internal corrosion from impure water, care and attention must be given to the fact that external corrosion is as frequent and dangerous as is the internal, yet it is not looked for except by an experienced engineer or boiler inspector. The causes which lead to external corrosion are less mysterious in their nature than the internal, and are generally the result of minute leakage from seams, tubes and joints, the moisture from difference in temperature between atmosphere and the water in boiler where the latter is allowed to cool, moisture from the ground carried by brick setting to boiler, leaky roofs of sheds called boiler-houses, in which this important part of a steam plant is too commonly placed. The practice of covering the top of horizontal boilers with brick is in itself injurious, and in many cases hides from the eye defects of a serious and alarming nature.

External corrosion may invariably be looked for around the connection of blow-off attachment to bottom of shell by bolts and nuts, or studs and nuts. It can also be looked for even when the flange-piece is riveted to shell, but is not as commonly found as where bolts are used. The reason of this is apparent by the use of bolts and nuts; packing of some sort is necessary to insure a tight joint at time of testing the boiler. Resort is then had to cement of red and white lead or heavy rubber, but after fire is applied the efficiency of both is affected, and leakage, serious in its nature, is sure to follow. In the case of bolts being used, there is not a uniformity in convexity of shell and concavity of flange to insure anything like tightness, even when the shell is mechanically round, as it is no uncommon practice to have the same pattern answer for flange castings in the case of 54″ to 66″ diameter of shell. In addition to this, the number and diameter of bolts used are usually insufficient to make a tight joint on a flat surface. How much more insufficient must they be in the case of two curved lines. Where the flange is riveted to shell, a tight joint can be made even when inequality in surfaces exists. As the sheet can be hammered and rivets must be driven inside, by this means overcoming the difference in curvature, caulking is then resorted to in order to complete the work, and it is an uncommon occurrence to have a riveted flange leak. In this connection, it is well to say that in no case should a curved flange be bolted to boiler shell or dome if riveting can be resorted to, as bolt joints seldom prove tight for any length of time.

The duties of inspection and cleaning of boiler should be personally attended to by some one interested in the safety and durability of boiler, otherwise neglect will surely follow. I lately had experience with a boiler the back hand-hole bolt of which had been wrenched off, and in this condition had been allowed to run for months. Of course the plate was not removed in this time, and the manager of the works, when his attention had been called to the matter, coolly stated that as the boilers were cleaned from the front under his personal supervision, and the nut of bolt "burned off," it made but little difference whether the back plate was removed or not, as the internal pressure held the plate in place and prevented serious damage. Ignorance in boiler setting is also responsible for serious defects to the ordinary horizontal boiler. This ignorance may be, and sometimes is, traceable to the plans of an inexperienced draftsman, whose design on paper is pleasing to the eye, but the practical utility of which is very questionable.

It not infrequently occurs that serious leakage takes place in the cylindrical seams of externally fired boilers, and the same has given rise to much discussion between the builder and user. One of the principal causes for this leakage is the introduction of the feed water at a low temperature in the immediate vicinity of the highly-heated metal, thus causing undue contraction, with the result already stated. Where a battery of boilers are used, and the feed pump of sufficient capacity to feed all at once if necessary, the introduction of feed water into any one of the battery should be done slowly, as where the full power of pump is used the water is forced with great power into the shell and comes violently in contact with the plate, even where proper internal feed pipes are used. Another and very serious cause of leakage is the practice of "blowing off" under pressure and allowing the boiler to cool with over-heated walls surrounding the boiler. The injury done in cases of this kind is far more serious than is generally believed. For this cause no boiler enclosed

in brick work should ever be blown off under any pressure, but the water should be allowed to run off by gravity, and the incrustation will be much less where the latter practice prevails than in the former, notwithstanding the theory that so much of the incrustation is carried off through the blow-cock. Steam should be generated slowly; that is, the practice of sharp firing to generate steam from cold water in a cold boiler should not be allowed, as this, in many cases, adds to the wear and tear of boiler by causing leakage, especially at the cylindrical seams, as the intense heat acting directly on the double thickness of metal unprotected by the water is apt to cause an undue expansion and consequent irruption of the caulking, the boiler builder frequently being blamed for defective workmanship. When the cause of leakage can be traced to the source already named, fracture of the edge of sheet is apt to follow the practice of sharp firing; at first the fracture being imperceptible, in time extending beyond the rivet holes to the solid plate. The expansion of an externally fired boiler causes, as has already been stated in a previous paper, a curvature of the shell and the throwing of weight of boiler and contents on the center brackets or lugs. When this is allowed, as it needs must be to allow the frequent cleaning of boiler, it follows in time that a rip or fracture of the transverse seam can be looked for. The patching of boilers has also been alluded to, as well as the skill of the workmen usually intrusted with this branch of boiler making. I would in this paper call attention to the fact that the iron in an old boiler from use becomes crystallized. When repairs are needed a heavy hammer and backing-out punch are used to drive out the old rivets, after the heads are cut off. This backing-out process, carried to excess, is apt to fracture the inside sheet, but no thought is given to this matter by the boiler owner, whose instruction to the workman is simply to "hurry up, I want to get running as soon as possible."

The boiler maker, or rather repairer, in his anxiety to please, and thus insure the liberality of the owner when his "time card" is to be made up, literally follows these instructions, in his desire to do so, not giving that attention to the alignment of his rivet hole, the latter being imperfect, and the "hurry up instructions" followed: the excessive use of drift follows and serious injury is thus done. To wind up the job, holder-on and rivet-boy are pressed into service, where possible, to caulk the patch, and the quality of the work thus done is best understood by those whose duty it is to inspect boilers after repairs have been made.

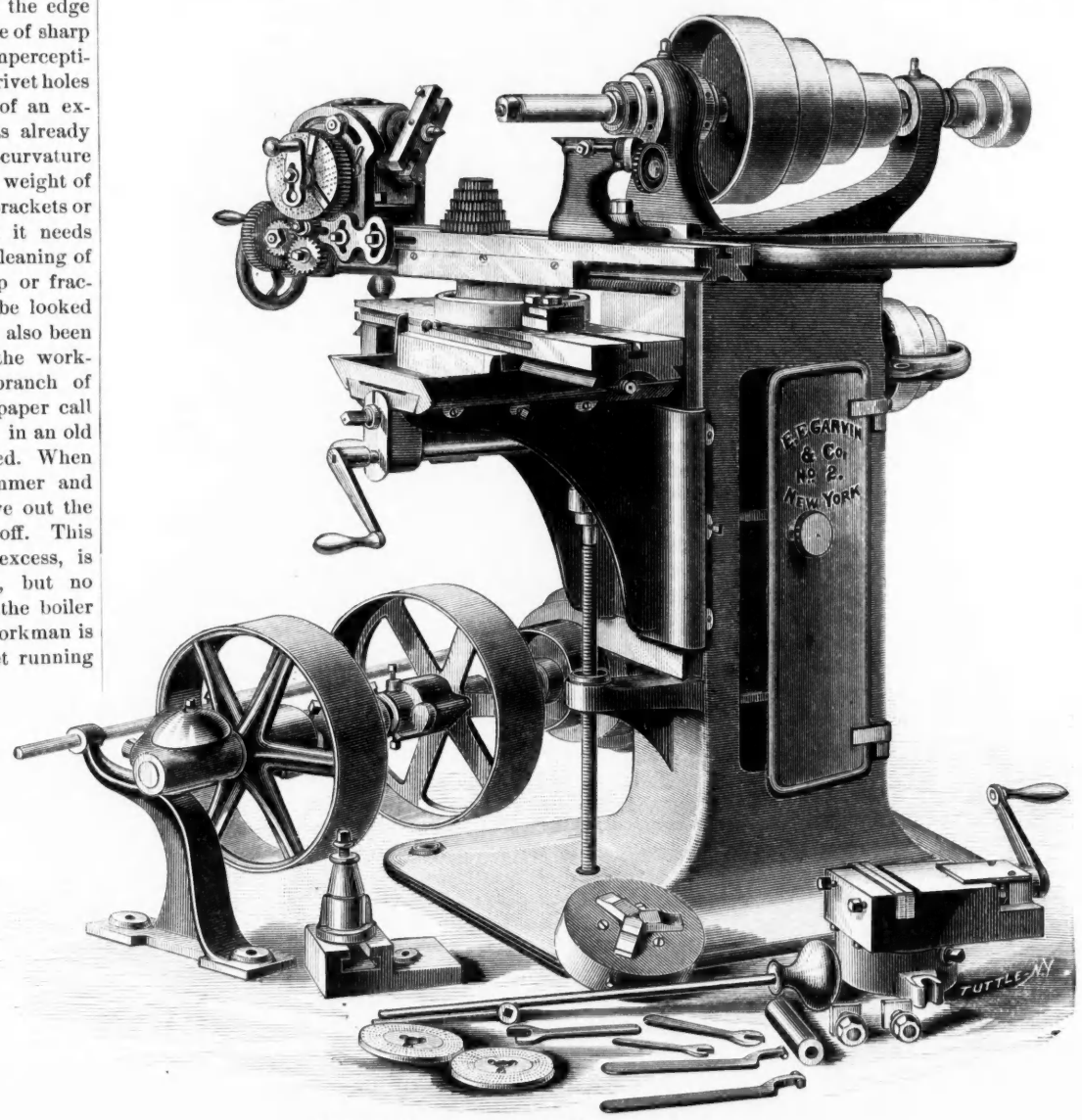
Poor material and unskilled workmanship are the causes of many so-called explosions. Intelligent inspection, good material and skilled labor could avert disaster.

In concluding this paper, permit me to say that the safety of any boiler must be considered, not from its original strength, but from the depreciation in strength caused from corrosion, age, ill usage, or defective construction or repair. For this reason inspection should be periodically and systematically resorted to by men of experience and judgment, on whose inspection and opinion the working pressure in each case should be determined; and a reduction in pressure after five years of continuous service should be the rule rather than the exception.

A vigorous effort has lately been made by the manufacturers of iron car wheels to secure a share of business from the elevated railroad company of New York, but they are not likely to succeed in displacing the paper wheel which is now used exclusively on that system of railroads. When the roads were first opened, several kinds of iron car wheels were tried, but none of them gave so much service or afforded the high degree of safety obtained from the paper wheel, so, in course of time, the latter became the recognized standard. There are now 220 locomotives and 576 coaches equipped with paper wheels, and, although they are subjected to great strain and change of temperature from brake action in making the numerous stops, there has not been a single recorded failure of this wheel during all the years it has been in use.

Spiral Attachment for Milling Machine.

There are several advantages in having a separate self-contained fixture for cutting spirals upon the universal milling machine. The important requirements of such a device are that it shall be of little height, and as portable and light as consistent with a durable and rigid design.



SPIRAL ATTACHMENT ON MILLING MACHINE.

We illustrate the spiral attachment manufactured by E. E. Garvin & Co., 138-143 Centre Street, New York City, as a creditable specimen of this class of machinery.

The fixture will swing ten inches, and take in a length between centers of twelve inches.

With the nine change gears furnished right and left-hand, spirals, from one turn in 1.66 inches to one turn in 5 feet, can be cut. The attachment is made from entirely new patterns, modified and improved upon the strength of reports and observations in its practical use.

A printed table for the arrangement of the gearing for spiral cutting, and another for handling the dials for graduating and dividing, are furnished by the manufacturers.

This attachment is shown in cut, mounted upon a No. 2 power milling machine.

The general dimensions of the milling machine are: Distance from center of spindle to top of table at lowest point, $17\frac{1}{2}''$; diameter of spindle, $2\frac{1}{8}''$; length of front bearing, $4''$; length of table, $28''$; width of table, $5''$; length of feed, $14\frac{1}{2}''$; adjustment to and from column, $6''$. Countershaft has friction clutch pulleys. Weight of machine and attachment, 1,250 lbs.

"Man in the Tertiaries," is the subject of an address by Prof. Wormley at the Science Association meeting in Philadelphia. Man in the Primaries engages more attention from the people of this country just now. He will get into the Tertiaries some time after election.

The Proposed American Exhibition in London.

The proposal to hold an American Exhibition in London is a novel idea, which will excite general interest if it is carried out on a comprehensive basis, and with every regard to efficiency, both as respects the management and the exhibits. The resources from which to collect the latter are so great that no difficulty ought to be experienced in organizing an exhibition that would be a fair representation of the productions of the great nation of the West.

Hitherto the American exhibits at European exhibitions have been most interesting, but they were comparatively limited in number, and failed to give a fair idea of the vast extent of American enterprise and the wide range of the national industries. It is asserted that the present proposal has received the heartiest support of railway directors, agriculturists, producers of raw material, and manufacturers. If the support given to the proposal is extended to the exhibition itself, then undoubtedly it will arouse an unprecedented amount of public attention in this country. In a tangible form information will be afforded respecting the productions of regions almost unknown to the majority of our countrymen, but which are being opened up by the great American railways. This will be an immense advantage to the crowded population of this overcrowded country, who must eventually seek in other lands the means of subsistence they are unable to obtain here. But not to the emigrant alone will information concerning the undeveloped territories of the West be invaluable. Capital is seeking for new outlets, and if it can be shown that there is a profitable return, on good security, in land transactions and industrial enterprises in the Far West, there is little doubt that investments will be readily made. Then there are the varied productions of American soil, ranging from the luscious fruits of the tropics to the vegetable growth of the temperate zone. Already the tinned fruit trade with this country is an important industry, and the exhibition would lead to its development. Beyond all this will be the illustration the exhibition will afford of the mechanical ingenuity and skill of Americans. There is a tendency in some quarters to depreciate the work of American machinists, and to imply that American inventions are only copies or adaptations of English productions.

It is well that those people who, from ignorance, undervalue American workmanship should be publicly disabused of the correctness of their notions, and that English machinists should be convinced of the high standard attained by their American rivals.

The writer of the notice of the Exhibition in *Engineering* probably goes too far when he says that "the English manufacturers will find that they will stand less in the position of past-masters, and more in the position of novices, than they have done in any previous exhibition in Europe," for the old country is not yet beaten in the race; and the rising generation of machinists are not wanting in native skill and ingenuity, while they have educational advantages their progenitors, who did great deeds, did not possess; nor are they slothful and indifferent to progress. At the same time, they will be able to learn much from the exhibits of their American competitors, and by the excellence of the machinery placed before them they will be stimulated to still further exertions.

At present the Exhibition has not taken a shape and form that warrants much to be said respecting it beyond a frank recognition of the great value and interest it will have, if properly carried out, for Englishmen generally. General C. B. Norton, who is an experienced organizer, and who commands the respect of many machinists of high repute in this country, is the promoter of the Exhibition, and he has already gathered around him a well-qualified staff of assistants. It is proposed to open the Exhibition in May, 1886, so as to give plenty of time for preparation, and also to allow many exhibitors at the New Orleans Exhibition also to exhibit in London.—*Manchester Textile Recorder.*

The American Electrical Exhibition will open in the Charitable Mechanic Association Building, in Boston, November 24, and continue until January 3, 1885. Applications for space must be made before November 1, upon blanks furnished for that purpose. P. H. Alexander is general manager. The circular says: "It is intended to make our exhibition complete and comprehensive in every particular, and to exceed in novelty any that has ever been held in New England. The projectors are confident that their motives will be appreciated by a generous public." The exhibits will be divided into classes, as follows: Production of electricity; electric conductors; measurements; application of electricity (low power); application of electricity (great power); terrestrial physics; historical apparatus; special novelties; electrical literature.

Sweet's Automatic Sand Moulder.

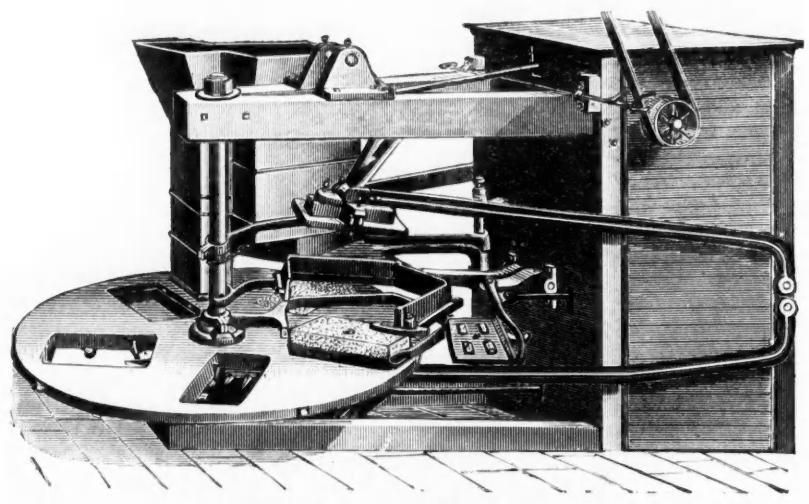
For hundreds of years the art of founding has remained comparatively the same. While machinery and improved appliances have changed all other branches of industry, in many instances revolutionizing them, both bettering and cheapening the product and making it more accessible to the masses, moulding is much the same as in the days of our ancestors. Finally there seems to be a yielding in this direction also, and we present herewith an illustration of a machine for moulding shelf hardware, and all that class of work usually done in snap flasks, which has just been completed by the Sweet Moulder Company, of Cleveland, O.

An intermittingly rotating moulding table has a series of open sand-carriers, provided with movable bottom-boards, which rest on stops below while receiving sand, and on spring-dogs above after it is raised into the drag and compressed against the under side of the match plate pattern. Each carrier passes under the hopper where it is filled with sand, and stops under the stationary drag and over the lower platen. The cope is filled and struck off by a swinging carrier having a movable bottom, which also passes under the sand hopper. The sand in the two half-flasks is compressed simultaneously by the two platens, the upper one carrying the gate pin. The platens are withdrawn, the cope is raised, followed by the pattern half as far, which is then swung out laterally, the cope is again replaced, the flasks opened, and the completed mould carried out by the table ready for removal and pouring. All this is done automatically, and at the rate of from two to four large moulds per minute.

While there is considerable to be accomplished, all the movements are very simple. Eight cams, arranged on a single vertical shaft in the body of the machine by means of suitable connecting links, operate the several parts. Having the same amount of sand compressed to the same extent and drawing the pattern without disfiguring the mould by rapping are both important items.

The common match plate, which is the most economical of all patterns in the long run, is used on this machine. The pattern arm is so arranged that patterns can generally be changed without stopping. Adaptations of the machine for heavy and cored work are made by the same manufacturers.

The device is manufactured by L. Schutte & Co., Philadelphia, and sold by A. Aller, 109 Liberty Street, New York.



SWEET'S AUTOMATIC SAND MOULDER.

Hot Water Nozzle.

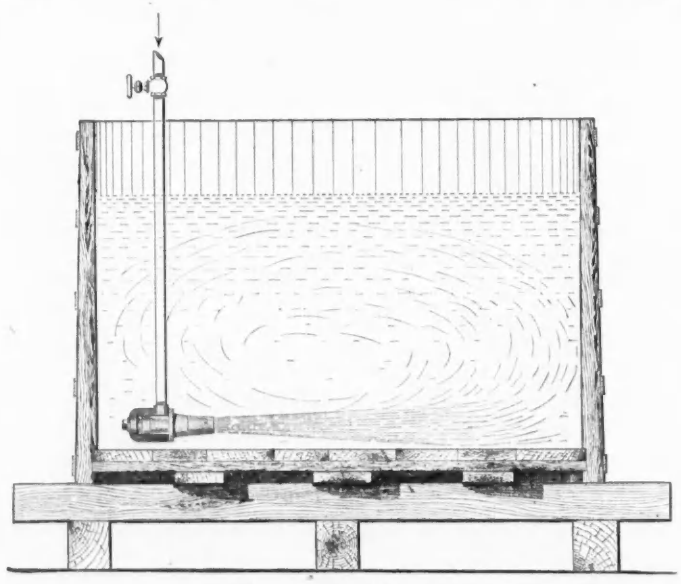
The general purpose of the device shown in the annexed cut is the heating of liquids by direct contact with steam, to fully utilize the heat at disposal, and to accomplish the transfer of the heat, from the steam to the liquid, without shocks or noise.

The annexed illustration shows the transfer attached to the end of a steam pipe and suspended in an open tank. Owing to the peculiar construction of the apparatus, which is composed of nozzles of different areas, a rapid circulation of the surrounding liquid is induced through the apparatus, at the same time causing a gradual increase in the temperature of the liquid up to the boiling point.

The advantage gained by the use of this apparatus over a plain steam pipe discharging under the liquid is considerable in economy, as more water will be heated with less steam in less time.

The reason for this is that the steam cannot escape to the surface of the water, but is brought and held in intimate contact with the water till its heat is diffused, thereby preventing waste of steam, as also economizing time by utilizing all the steam that has passed into the water.

Another advantage is the absence of the rattling noise caused by the collapsing of steam globules when discharging by a plain pipe under water. How annoying to the ear and injurious to the tanks is this escape of steam from an open pipe, need not be pointedout. With this arrangement of nozzles there is an entire absence of these undesirable features, and the circulation continues rapid and regular at all temperatures.



HOT WATER NOZZLE.

LETTERS FROM PRACTICAL MEN.

Economy of Compound Locomotives.

Editor American Machinist:

Your issue of August 30 contains a paragraph referring to the Webb compound locomotive in a manner that may prove misleading to those who have not personally examined the machine and its working; and, as nothing can be gained by ignoring facts which are especially significant and instructive, I venture to offer a comparison or two bearing upon the fuel consumption of this and other engines doing similar work. Excessive fuel consumption is the weak point of most of our locomotives, and I think Mr. Sinclair did well in calling attention to it at a recent convention of master mechanics. If that gentleman's estimate of the average coal consumption of about sixty pounds per mile is taken for correct, as it undoubtedly is, it is certainly time that something should be done to improve the record, and it does not help matters in the least to belittle what seems to be so far the most successful effort in fuel economy in English locomotive practice. From personal observation the writer can say that the Webb compound locomotives do the heavy express work on the London and North Western Railway with a fuel consumption of about twenty-eight pounds per mile, which is fully fifteen per cent. less than the best of other engines can show with the same working conditions. Undoubtedly there are locomotives running in Europe with a fuel consumption of less than twenty-eight pounds per mile, but they are doing lighter work than the Webb compound, and in comparison with them in countries where the crank axle is not considered objectionable, the compound cannot be called a failure in any sense of the word. Besides this, the engine is remarkably steady at high speeds, which, perhaps, may be accounted for by the very efficient leading truck which Mr. Webb uses, together with the absence of coupling rods. As for the comparison between our own standard type of passenger locomotive and the non-compound locomotive of Europe, the writer knows of only one engine here which is doing about the same service with the same fuel consumption, though there may be others of which he has not heard. The engine referred to, which is of recent design, hauls on an average about eight cars at a speed of forty-five miles an hour, on a line having heavy grades one-sixth of the distance, with a fuel consumption of about thirty-four pounds of bituminous coal per mile. If this is considered to be phenomenal, what can be said of an engine that is twenty per cent. more economical, which is the case with the Webb compound? It undoubtedly is an outgrowth of the inventor's personality, and anyone who has enjoyed the privilege of examining the Crewe works, where the London and North Western locomotives are constructed, will readily acknowledge the presence of a very strong personality at the head of the establishment; for the quantity and quality of work turned out is something to command the admiration of all practical and unprejudiced engineers. As for the bearing of the aforesaid personality upon the brake question (to which your article refers), Mr. Webb, in common with many other eminent European engineers, considered the brake in question to be dangerously complicated, and, "having the courage of his convictions," could not be induced to change them by any of the peculiar methods which are sometimes used to effect conversion in such cases.

J. T. M.

Definition of Dynamical Units.

Editor American Machinist:

Mr. Ed. T. Williams' explanation (Sept. 20), of a pound when used as a unit of force, to be measured by the attraction of a pound of mass in London (or at any place where the acceleratrix $g=32.19$ feet, English), is acceptable in answer to my question (Sept. 6), although I beg to take exception to his (or Ganot's) definition of the unit of force.

Firstly, the generally accepted unit of force is the pound (measure of energy = foot pound, etc); and secondly, the given definition is the result of a confusion of dynamical definitions, which is no credit to the present standpoint of the science of dynamics. I write this not so much to criticise Mr. Williams as to offer for discussion a subject which I think needs rectification.

Ganot measures *time* by the *uniform velocity* of the earth's rotation on its axis, and defines *uniform velocity* by referring it to the *measure of time*. This is as bad as Webster's definition of time: "a part of duration," while he defines duration as "continuance in time." These are rather circular definitions.

It is true, we are so accustomed to measuring time by the practically unchangeable motion of our planet that we never think of analyzing this source, but I cannot see why this should give us a right to permit the above inconsistency.

Time cannot be measured without referring a definite (linear or angular) velocity to a definite (linear or angular) space. A definite velocity cannot be produced without allowing a definite force to act on a definite mass through a definite space, hence the unit of force must be defined before we can define a unit of time.

If the dynamical definitions were given substantially in the following order, the named inconsistencies would at least be avoided.

Matter is anything the existence of which we can perceive through our senses.

Space is that which is capable of containing matter. Distance is the element of space.

Duration is the continued existence of matter.

Motion is a relative change of location.

Force is a tendency to produce, change or arrest motion. A number of forces acting on one body are "in balance" if they produce no motion.

Mass is the measure of matter.

Velocity is the measure of motion. It is uniform if no force intervenes in the direction of motion.

Time is the measure of duration, and as such cannot be conceived without motion. It is the relation of distance (space) to velocity.

The *unit of space* (distance) is the standard foot (London), or the standard meter (Paris).

The *standard* (not unit) *of mass* is the standard pound (London), or the kilogram (Paris).

The unit of force is the weight of the standard mass at certain places of the surface of the earth.

The *unit of velocity* is that attained by a unit of mass initially at rest, if a unit of force is applied through one-half of a unit of space.

The unit of time is measured by a body possessing unit velocity passing through a unit of space. In order to make the thus defined unit of time agree with our arbitrary but generally adopted unit, the second, it has been agreed to re-adjust the unit for mass, making the same 32.19 standard pounds (English system), or 9.808 kilograms (French system). If we had not to adapt ourselves to this arbitrary time standard, the pound (kilogram) would undoubtedly have been adopted as the unit of mass.

The point which I desire to make may look very much like hair-splitting, but I don't think it can be denied that the usual definition of uniform motion, which is based on a pre-existing uniform velocity, lacks as much of the essential feature of a definition as Webster's definition of time does.

HUGO BILGRAM.

Philadelphia, Sept. 12, 1884.

Machine Shop Floor.

Editor American Machinist:

I had promised you a specimen of work and a recipe of our new process of black lines on white paper. This I will send you in the course of two or three days.

I noticed a question in last week's paper in regard to a suitable floor for a machine shop. We have placed in our machine shop broken stones, well rammed, thirteen inches deep, on well-rolled earth. This stone is mixed

with cement and sand; on top of that we put four inches of Portland cement and one inch of asphalt, making in all eighteen inches. This floor is strong enough for all tools. We have only built foundations for such tools as wheel lathes and boring machines, which are required to go some distance below the floor line.

Any other information you may desire we will be happy to reply to your wishes.

S. H. Harrington,
Chief Draftsman.
P. C. and St. Louis Railway, Columbus, O.

A Long Train Pulled by a Mason Engine.

Editor American Machinist:

The following authentic account of a heavy haul is sent in response to the invitation in a recent number:

The load consisted of 17 long cars and 224 short cars, loaded with coke, coal and ore, weighing 2,394 tons, besides the engine. The latter is a Mason bogie switcher, weighing, with tender, 54 tons, 36 tons of which is used for adhesive effect, being equally distributed on 6 drivers, 50 inches diameter. Cylinders, 17x24; boiler pressure, 135 lbs. Hauled on a 6° curve with apparent ease. Reader.

Proportioning Slide Valves and Determining the Effect of Different Proportions.

Editor American Machinist:

So far as the former letters on the above subjects relate, they have only dealt with the means showing what a valve already constructed would do. To determine how to proportion a valve so as to accomplish certain results is in one sense to simply reverse the operation, and in another sense it raises the question what do we wish to do? To determine that opens the question of steam engineering.

So far as this question of proportioning slide valves is concerned the diagrams give no aid, that is, we must first determine what we wish to do, and by the use of the diagrams find out how to do it. Why it is that there are points that must be determined by guess or judgment, or by some formula that some one else has guessed at or based on their judgment is this: If it was required to have a pressure in the steam cylinder equal to boiler pressure while the engine is in motion the ports and passages would have to be about as large as the cylinder itself, but if we are willing to lose a part of this pressure, then the ports and passages can be smaller. If we conclude that we will be content to have, say, five per cent. less pressure in the cylinder than in the boiler, then comes the size and length of steam pipes, ports, passages, size and speed of engine, smoothness, roughness, crookedness, etc. So that probably the guess of an experienced man would come about as near correct as the figures of a mathematician.

Advice sought in regard to the proportions of ports and valve is more likely to be wanted by those interested in building small engines, and nothing can be given but what would be sure to be criticised, and justly criticised, because the wants and conditions are so various. But it will be safe to say probably that for a piston speed of 600 feet per minute, a port and passage $\frac{1}{16}$ the area of the cylinder, which is about $7\frac{3}{4}'' \times 1''$ for a 10″ engine will be ample, and not over $\frac{3}{4}$ that size for one half that speed.

Sometimes it is desirable to make the ports as long or longer than the diameter of cylinder. That is, for a 10-inch cylinder a port $\frac{3}{4}'' \times 10\frac{1}{2}''$ or 11″, and of these the long and narrow, or short and wide, must be determined by the conditions or design of the engine. Each style has its advantages which about balance, and for an unbalanced slide I cannot give an opinion. For a balanced valve my choice would be a narrow valve and greater width of port, and greater travel—giving shorter passages and less friction surfaces for steam in passages. After the width of port is determined, assume the

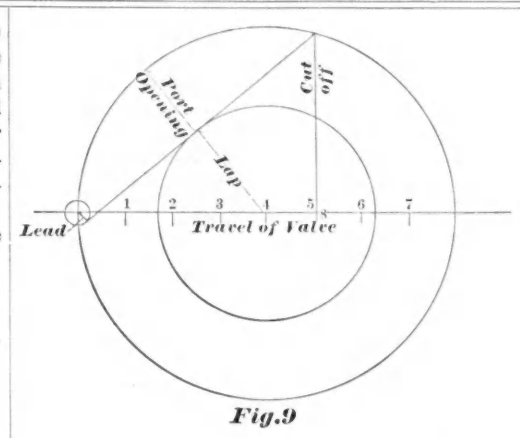


Fig.9

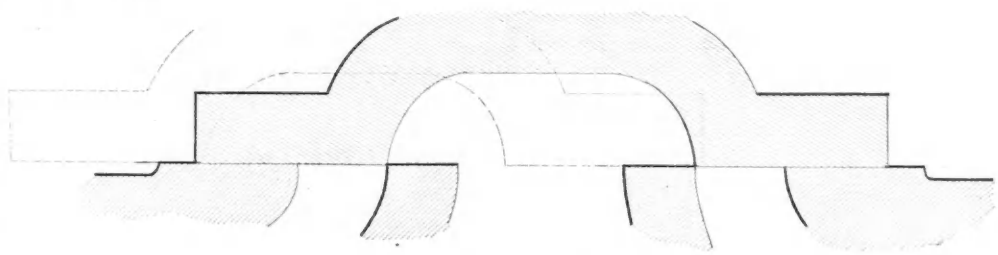


Fig. 10.—Proportioning Slide Valves.

engine to cut off at $\frac{5}{8}$ stroke and proceed to determine the lap as follows: Strike the circle *A*, Fig. 9, with a diameter four times that of the width of port. Set off on the line *B* five-eighths its length, and erect the perpendicular *C*. Strike the circle *D* with the radius equal to the lead, say $\frac{1}{8}''$ (although that is not the way lead ought to be given*) and then strike the diagonal *E* and circle *F* so as to cut the line *E*, and its radius is equal to the lap of the valve. Make the bridges between the steam and exhaust ports three-fourths the width of ports, the face of valve seat outside the port $1\frac{1}{2}$ times the width of port and the exhaust port equal to width of port and bridge†. With these proportions the exhaust port will be partially closed near the middle of the return stroke, but with the proportions given not enough to raise the back pressure. There are probably very few cases where these proportions would be the best that could be found. But they will do to start with, and although there is one point greatly at variance with common practice, it will stand any amount of trial without suffering by comparison. It will be seen by Fig. 8, which shows a section of valve and seat, with the proportions given above, that the wearing surface of valve and seat are about equal.

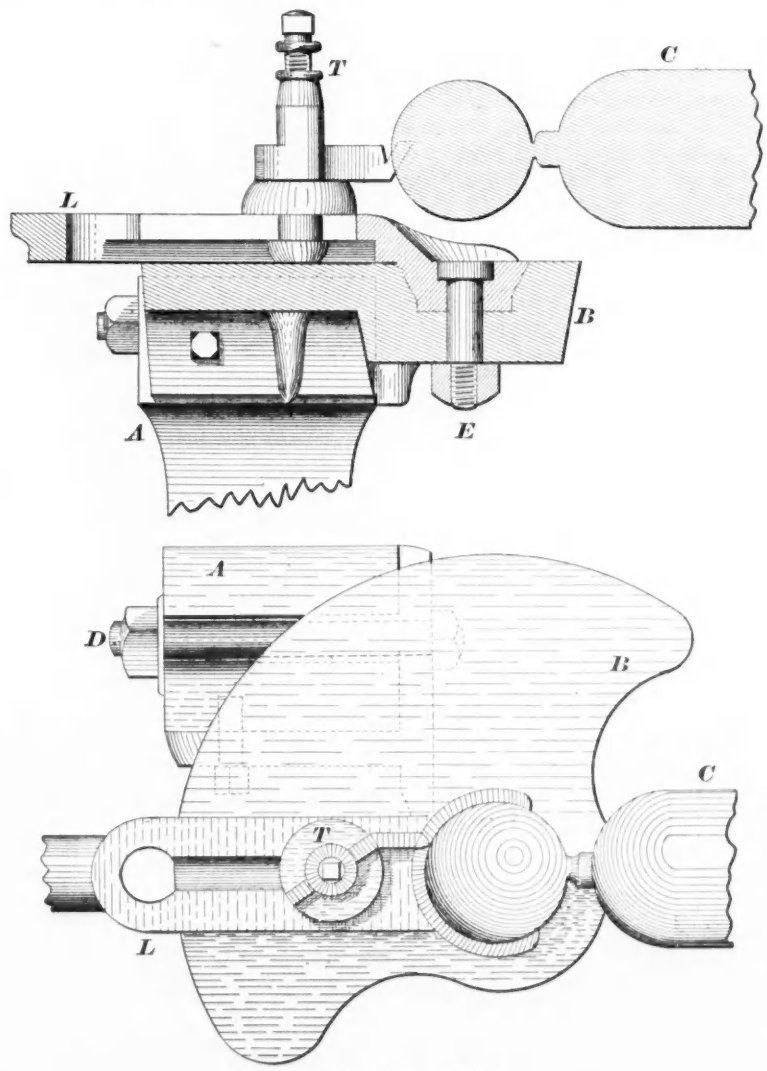
These same proportions will do for cutting off at $\frac{3}{4}$ stroke by giving the valve the same travel and less lap, or for cutting off shorter than $\frac{3}{8}$ by keeping the lap the same, and shortening the travel, leaving the ports and passages the same, but the port opening less. John E. Sweet.

Syracuse, N. Y.

* An $\frac{1}{8}''$ lead to a valve having 4″ travel would be no greater in proportion than 1-16″ lead to a valve of 2″ travel, so that to say a valve has $\frac{1}{8}''$ lead without knowing the travel of valve, is simply indefinite, and yet it is so common that no other term is likely to be substituted. Possibly it serves its purpose as no one can predict in advance just how much it will take to keep an engine from thumping, and that is what determines the question in the end.

† The width of exhaust port is a matter requiring no special accuracy, as it is nothing more nor less than a hole to let out steam, and the edges have nothing to do with its distribution. In an unbalanced valve as narrow exhaust port as possible is desirable so as to reduce the size of valve (as it requires less power to operate a small valve than a large one) but the exhaust must not be so narrow as to have the valve close it up during the return stroke.

Narrowing the bridges also would help to reduce the size of valve, but if made too narrow there is more liability to leak—and when that takes place the iron is soon cut away and the loss becomes serious.



Device for Turning Balls.

Device for Turning Balls.

Editor American Machinist:

I find in your column of "Letters from Pratical Men" a good many things that are of value in mastering some peculiar and uncommon jobs. I enclose a sketch of an attachment for the common engine lathe which, if you think worth while, is at your disposal.

While employed in a small country shop certain parties wanted quite a number of friction balls turned for the step of a heavy coal crane in the place of cast ones. The job had been refused by another shop on the ground that it could not be done without expensive special machinery. When the job came to the shop the proprietor brought it to me, and asked if it could be done in any way to be satisfactory. After thinking it over, I replied that it could, took the job and brought it out all satisfactory in workmanship and price. I do not remember to have seen such arrangement described or used, so thought it might perhaps be of benefit to others, as it has since been used for turning balls on hand cranks and similar jobs.

A in sketch represents tool-post block, to which table *B* is fitted and firmly secured by a large bolt passing through tool-post slot, and a cap screw tapped into block on inside. Table *B* is extended inwards on to one side, making a little more than a half circle upon which the tool lever *L* slides, which lever is fitted to a suitable countersink in table and is firmly held to place by a bolt and nut *E*. The small tool-post *T* is adjustable for different diameters by means of the slot in *L*, the set for cut or chip being done by simply knocking the curved tool around in the post. To adjust the center directly under the center of ball, a chip is taken off to get a cut evenly around and then calipered and the rest to carriage mould until the calipers showed the ball to be round, and then finished to size. To hold the piece in the lathe a number of balls are blocked out on the bar of metal and then put into the center rest and chuck. McN.

Muncie, Ind.

Locomotive Side Rods.

Editor American Machinist:

Our attention has been called to paragraph on page 6 of your issue of Sept. 20th in which you say that the Pennsylvania Railroad Company have had trouble with locomotive side-rods breaking, and have concluded to go back to the plain section of rod.

As this may possibly be misleading to some of your readers, I would say, that for a long time we have had no broken rods, and are fully convinced that the I section of rod, as at present used, is the best form for side rods. Theo. N. Ely,

Supt. of Motive Power Penna. Railroad.
Altoona, Pa., Sept. 15, 1884.

Not a Novel Feature.

Editor American Machinist:

In your issue of September 20th is an illustration of a Mogul locomotive by the Schenectady Works, and in your description of the same you mention the placing of the fire-box above the frame as the "principal novel feature," etc. The placing of the fire-box above and over the frames has been practiced by the Baldwin Works for many years for both hard and soft coal-burners, and the manner of carrying the fire-box on links screwed to its sides was borrowed from the Philadelphia and Reading Railroad. It may be *new* to your writer, but is, *in fact*, old.

Erie. In Truth.

To Remove Iron Chips from the Eye.

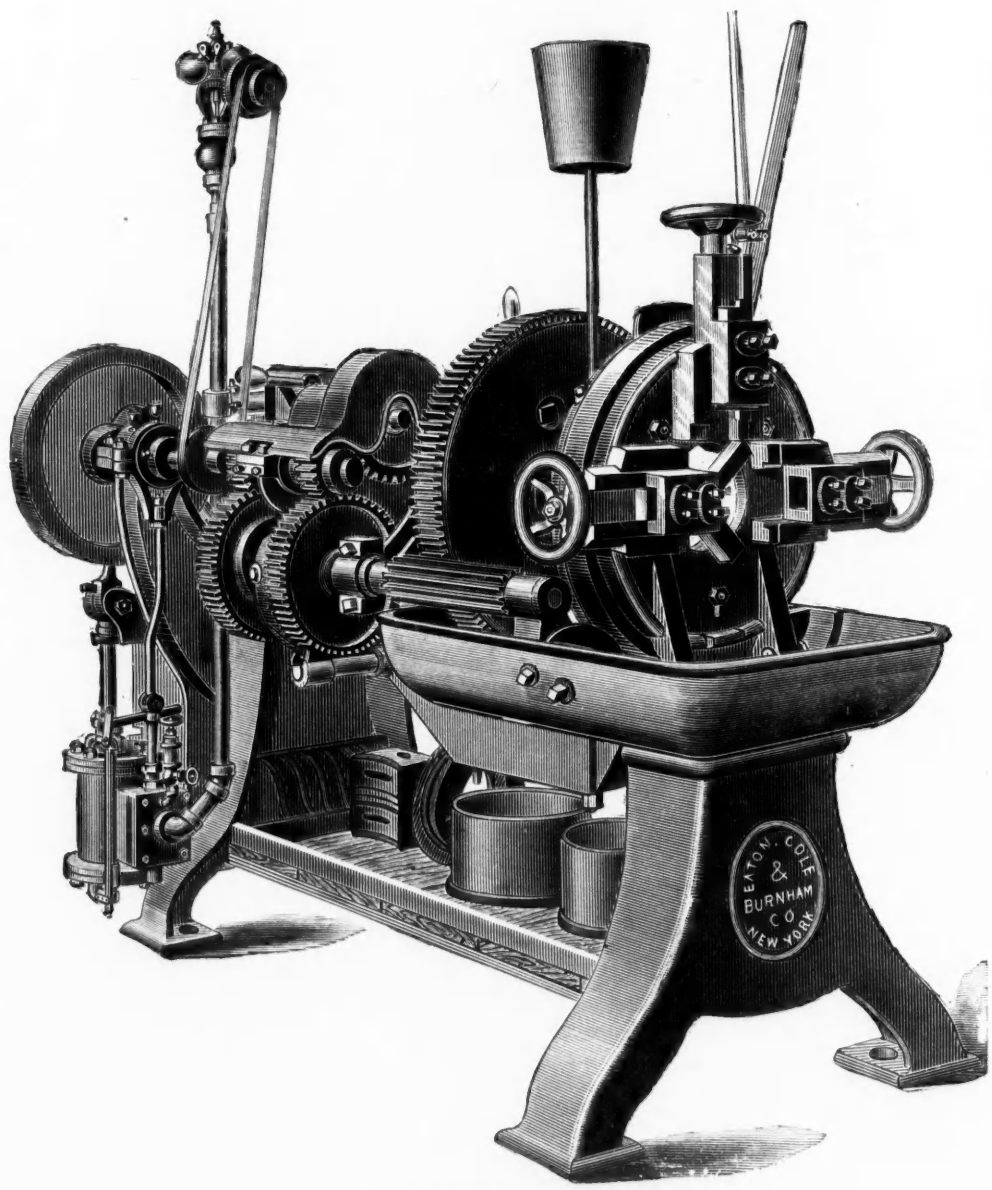
Editor American Machinist:

The suggestion in your paper this week about removing foreign substances from the eye prompts me to offer a wrinkle that perhaps may not be well known in "shop surgery." There is always some one in the shop who is called upon to operate on the crushed finger or chip in the eye. So let him provide himself with a sharp pointed blade, thoroughly magnetized, and in many cases he can remove a troublesome piece of iron or steel without touching the eye. Mack.

Pipe Threading Machine.

The annexed illustration shows in perspective a pipe threading machine with a range from 1 to 6 inches, and having steam actuating machinery attached to the frame and connected direct to shaft of the machine. In several respects the design of this machine is different from the ordinary pattern of screw-cutting machines. The dies are secured immovably, substantial provision being made to keep the pipe perfectly straight and central. The die head, which is the front of the cut, is bolted solidly to the bed of the machine and a concentric chuck, provided with a horizontal movement, carries the pipe to the dies. This chuck has three steel jaws which are actuated by an eccentric ring driven by gear and worm, making a most powerful means of holding the pipe straight and rendering it impossible to cut a crooked thread. At the back of the spindle there is a feeding device which can be thrown out of operation without stopping the work. In cutting threads the dies are opened by throwing over an actuating lever, thus relieving the pipe so soon as it is cut, and permitting the use of the cutting tool secured in front of the die head without removing the dies or swinging to one side.

The machine has cone pulleys for regulating the different speeds to suit the size of pipe to be cut. No gearing has to be changed; and all gears are machine-cut securing perfect fitting-teeth. The power is applied to the geared periphery of the chuck holding the pipe by its sliding on a long pinion, a method which prevents undue strain being put upon the spindle. Where it is not considered desirable to have the engine attached to the machine, tools of the same size and form are made with countershaft and pulleys complete. This machine in varied sizes is made by the Eaton, Cole & Burnham Company, 84 Fulton Street, New York.



Pipe Threading Machine.

Technical Morality.

Technical education is supposed to have reached its greatest development in Saxony, but it is just possible that the much-by-some-people-envied advantages of a greatly lauded system are not so valuable as are supposed. We know, for example, that at least one Saxon firm employs ex-pupils of these schools and others in their own works and in the works of many unsuspecting British and American engineers for the purpose of copying or supplying them with drawings of new tools and machines. This probably is one reason why these men are prepared to accept a very low scale of remuneration from the firms whom they are professedly serving but actually robbing in the most shameless and injurious fashion. Technical schools, then, do not tend to foster morality; but this is not their object. It seems, however, to be borne out that the exigencies of the system make so great demands on the time of the pupil that little or none is left to be devoted to the acquisition of the commonest principles of a knowledge of good and evil, right and wrong. If a student enters the schools with these principles already implanted, well and good; but if he does not, and too often he does not, then his special knowledge is likely to be misdirected. Probably many of our readers can recall examples of perverted ingenuity, of rare technical skill applied to the basest, or at least, to useless purposes, of a squandering of the talents for dust and ashes, of a "want of ballast" as it is often put, which leads to wreck many a one who would but for the want of this same "ballast" have been of as great use to the world as the late Sir William Siemens. It is an insoluble problem to determine what the world has lost through this failing in individuals. Many of them, now fresh in our recollection, have shown of what brilliant things they were capable, and then have suddenly disappeared in the darkness of a felon's cell, or a dishonored grave. To mention names would be to heap insult on a failure that calls only for pity. Let them rest in peace, and may the memory of what was good in them be green, but let also their lives be more useful than themselves have made them. Something more than mere technical education is wanted. The student should also be taught to apply his skill for the benefit of himself and his fellows. His skill is the weapon with which he has to fight life's battle, and he is but a poor soldier who does not know best how to use his weapons. It might be worth the labor of another Royal Commission, and more productive of good, to ascertain how the parallel training might best be accomplished.—*Mechanical World.*

New Case of Perpetual Motion.

The latest perpetual motion scheme is wafted from Sharpsburg, Pa., where a local workman has produced an arrangement of hollow globes, which, he assures the world, will beat Keely's perpetual motion machine. If this Sharpsburg genius beats Keely in the latter's specialty of beating too credulous capitalists, he will be a credit to the name of the town which his fame will be associated with. The Sharpsburg inventor has one commendable attribute to his character—he is perfectly frank in telling what line he is working on, and calls it perpetual motion. The man appears to have some success-like perceptions, for he talks about atmospheric crusts and other vague nothingnesses as glibly as the great Keely ever did. The man wants to be advertised, and we willingly come to his aid, since we think his method of doing business is much more worthy of admiration than the line followed by numerous perpetual-motion inventors, who disguise their schemes under high-sounding names that are calculated to deceive investors. The following is a verbatim copy of an advertisement sent by the latest apostle of perpetual motion to a Pittsburgh paper:

"Wanted—twoo form a stock Co on a new Pattend the Wonder & curriossity of the World. Propettule Motion in combination with the commicle motor none ned apply except Menn that menns bissness and have nolige of the Sinetific ort of Propetule Power apply twoo Jacob Keyer at Sharpsburg Pa."

Pitch of Milling Cutter Teeth.

By Fred. J. Miller.

The question of the relation between the rate of the feed and the speed of milling cutters naturally leads to a consideration of the question of the pitch of the teeth of the cutters, because either by changing the relative rate of speed and feed, or by making the cutters coarser or finer in pitch, the amount of metal moved by each tooth at each revolution may be varied. With this important difference, however, that by the first method the amount of work done will depend upon the cutting speed, the amount of metal removed per tooth per revolution remaining the same, while by the latter, within certain limits, the amount of work done will vary inversely as the pitch of the cutters, both the cutting speed and the amount of metal removed per tooth per revolution remaining the same.

The question of the relative merits of fine and coarse pitched cutters has before received some attention in the columns of the American Machinist, the bulk of the testimony, if I mistake not, going to show that cutters of coarse pitch were preferable on account of greater capacity.

This, I think, must be attributed largely to the natural disposition of mankind to invest anything which they have chosen to use in preference to others of its kind with virtues which it does not possess, thereby strengthening the evidence as to the wisdom of the choice.

There are cutters in the market which as regards accuracy of shape and general workmanship are admirable, and they are extensively used on work where it is important to maintain accuracy of form. Being especially valuable for gear cutting, they are of coarse pitch, and I presume are made so only because owing to certain peculiarities of form they can be better made that way, and can also be more conveniently sharpened by grinding than if made finer, and it is easy to see how users of them, admiring them for their many real excellencies, should be led to credit them with advantages which even the makers do not claim for them, such as superior capacity for instance. Of course I will not pretend to say that there could not possibly be conditions under which a cutter having coarse teeth would do more work than one having fine teeth, but I can say that I have never encountered such conditions, and that I have never talked with a practical mechanic who had, and my experience, as well as that of every mechanic I ever talked with on the subject, goes to show that fine toothed cutters are far preferable as regards capacity. A friend of mine, one of the best of mechanics, at one time was superintendent of a shop in which a great many small bevel gears were made for sewing machines. They were cut by the piece and quite rapidly. Not being entirely satisfied with the quality of them he thought to improve them by using the patent cutters. He improved them but at such a great increase of cost of cutting that he was compelled to return to the use of the original cutters and improve the gears by other means. He attributes the increased cost of cutting when using the patent cutters entirely to the fact that a cutter of given size had only about one-half as many teeth as one of the same size previously used. He thoroughly tested the matter, feeding both automatically and by a foot treadle, and the amount of work done was almost exactly in inverse proportion to the pitch of the teeth of the cutters. Knowing the character and ability of the man as I do, I consider this of itself about sufficient to prove that whatever other advantages may be claimed, it cannot and will not be demonstrated that coarse pitch cutters are capable of doing more work than those of finer pitch. A simple illustration will show the principle quite plainly.

We will suppose that we make a cutter with only one tooth in it; now, it is clear that some limit will be found to the rate of speed which it is possible to use with this single tooth, and we will suppose it is found that the work can be fed forward .01″ at each revolution of this peculiar cutter; then is it not evident that if a second tooth be placed diametrically opposite to this one that it also may remove .01″ of metal while the first tooth is loafing around out of its cut, and that this is done without imposing any more strain upon the machine, the cutter or the work than before, but simply imposing that strain twice as often, and is it not also evident that in order to make each of these teeth cut .01″ per revolution the rate of feed must be doubled? Then suppose two more teeth are added, making four, is it not evident again that the feed may be doubled the second time without increasing the strain upon any one tooth, or the maximum strain upon the machine, and, this being the case, does it not seem reasonable that this process of adding teeth may be continued with corresponding advantage until we have what is considered a fine pitch cutter? Of course there is a limit to this, but I think it is not passed until the teeth become too small and close together to be conveniently ground. And when, as in a case which has been cited in these columns, a shaper is used to cut spur gears, and does the work faster

than it had been done on a gear cutter, I am compelled, in the light of experience, both of my own and others, to conclude that the comparison must have been made between a very good shaper and a very poor gear cutter.

The method of improving cut gears alluded to above, consisted of two shafts upon which a pair of gears needing "improvement" could be placed in such a way as that one could be made to drive the other. Then, while running together, oil and fine sand were dropped upon the teeth, and the shafts gradually brought together as the grinding proceeded, by means of properly adjusted weights, until the wheels were ground sufficiently close together, when the machine automatically stopped. They were then removed, washed, and run together upon a machine which was mounted upon a box so made as to constitute a kind of sounding board, so that any noise made by them could be heard, and if any noise was heard they were reground or remelted.

Now, I have to confess that I don't know whether the teeth in these gears were made theoretically correct by this grinding process or not, but I do know that they ran together very easily, smoothly, and quietly, at any desired speed, which was the object sought, an object, by the way, much more frequently sought than obtained by makers of gearing.

The Lawson Non-Explosive Boiler.

Several years ago considerable attention was excited in the mechanical world by experiments made near Pittsburgh, Pa., by Mr. D. T. Lawson to ascertain the cause of boiler explosions. He exploded two boilers in the course of his investigations, and from the experience thus derived, and from certain preconceived ideas, he has built up the following theory of boiler explosions:

"The only explosive material about a steam-boiler is water; and water when superheated, which can be done only under pressure, will explode upon a sudden removal of that pressure, with a force quite equal to that of dynamite.

"The boiling-point of water varies with pressure. In a vacuum water boils at 70° sensible heat. Under atmospheric pressure it boils at 212°, and cannot be made hotter unless confined under additional pressure, because the escaping steam carries off the heat as fast as fire can impart it. In a steam-boiler under 10 lbs. pressure it boils at 241°; 50 lbs., 300°; 100 lbs., 340°; 200 lbs., 389°.

"Water when heated to the boiling point, requires 966° additional heat to change it from the state of water to the state of steam. This change is substantially instantaneous at all pressures. As each molecule of water absorbs the last of the 966° it instantly explodes into steam. As the last degree is absorbed cohesion is overcome and repulsion becomes the predominant power.

"The change of steam to water is also instantaneous. Steam remains in its new state only so long as it retains the 966° of latent heat, and the moment it at full volume, with only 212° of sensible heat, parts with one of these degrees of latent heat, it returns to water.

"The explosion of water is similar to that of gunpowder in some respects, but different in others. Each grain of gunpowder passing from the solid to the gaseous state explodes when it has absorbed a certain degree of heat. So with water. Each molecule of water, at the instant it has absorbed 966° of heat above the boiling-point, explodes and passes from water into steam. The expansive quality of the two is different, powder increasing in bulk 800 times, while water increases 1,720 times. The mode of exploding and the general result, large and sudden increase of bulk, are similar. In other respects they differ widely; the explosion of powder is by chemical action; the explosion of water is a physical change only.

"Water differs widely from powder and all other explosives in another remarkable particular. Only a portion of the water may explode—one molecule, the half, or the whole mass. These various amounts in exploding produce results ranging from violent explosions to mild ruptures and the safe operation of the boiler.

"When a grain of powder starts to go from the solid to the gaseous state no power can stop it. It may be confined, but combustion, once begun, goes on to completion. So with a molecule of water. It may be put under such pressure that it will not fully expand, but, once begun, it changes its state from water to steam.

"The true source of development of the great destructive power in a steam-boiler is the sudden *concentration* of the sensible heat in the water above 212° (or above 70° in case of a vacuum caused by the condensation of steam) into a part of the molecules of water, passing into them the 966° necessary to change them from the state of water to the state of steam.

"That the stored heat in a boiler concentrates to form steam is shown by familiar experiments:

"As for instance, causing water at less than 212° to boil by placing it in a vacuum; or by merely condensing the steam over heated water in a bottle.

"Again, take a steam boiler under a pressure of 100 pounds and a corresponding temperature of 340°. Remove the fire, and the formation of steam will cease. After a short time raise the safety-valve, and the water will begin to boil, and generate and give off steam continuously as the pressure is reduced, until a temperature of 212° is reached, and enough steam will be thus generated and blown off to fill the boiler very many times.

"These tests show that the boiling-point of water is lowered by simply diminishing the pressure. They show this, and also show the true theory of boiler explosions. They prove in the most conclusive manner that the sensible heat above 70° stored in the water concentrates in a part of the molecules of water, giving to them the 966° necessary to change them into steam. The water ceases to boil, no heat is applied, and by merely reducing the pressure the water again boils. The 966° above the boiling-point necessary to cause ebullition are not absorbed from the fire at the instant the water begins to boil the second time. They are already stored up in the water.

"Take a boiler containing 10,000 lbs. of water at a pressure of 200 lbs. and corresponding temperature of 389°. Suddenly reduce the pressure to 50 lbs. per square inch, under which pressure water explodes at 300°. There are stored in each of the 10,000 lbs. of water 89° of sensible heat above the exploding point—in the aggregate 890,000 thermal units, enough to convert 921 lbs. of this superheated water into steam. In an instant these 89° of sensible heat in each pound of water are absorbed by the molecules of water at the surface and for a considerable depth, and suddenly these 921 lbs. of superheated water explode into steam.

"Thus it will be seen that there is sufficient destructive power stored in the boiler when thus put in action to cause an explosion. If the reduction of the pressure caused by the withdrawal of steam be moderate, and such draught be continuous and uniform, there will be no danger; but if the draught is considerable in quantity and instantly checked, the nascent steam thus suddenly formed and thus suddenly checked will give an *impact or striking blow* upon the shell of the boiler, the aggregate force of which is equal to the weight of the water before it passed into nascent steam multiplied by the square of the velocity with which it strikes.

"The instantaneous check to the exploding water acts upon the boiler with the same effect as that produced by quickly closing the valve of a water main. In the one case it is the weight of the falling water, and in the other it is the force of exploding water, but the striking effect of the blows is the same, and is measured by the same rule."

* * * * *

"The rational solution of a steam boiler explosion is this:

"The water in the boiler, under pressure, is superheated, and possesses a highly expansive power. Upon a sudden removal of the pressure, without a corresponding reduction of the temperature, it starts into violent evaporation. This mass of nascent steam is checked by coming in contact with the solid and unyielding shell of the boiler. The result is that the aggregate force of this nascent steam strikes every square inch of the shell of the boiler at the same instant and with the same force, and with a power far in excess of the tensile strength of the boiler; and, moreover, this force is augmented at the instant the shell gives way by an immense reserve power caused by the further evaporation of the water in the boiler."

The remedy proposed is in the construction of a boiler with a partition plate dividing the boiler into two compartments, as seen in Figs. 1, 2 and 3. This plate is perforated with holes, whose combined area is less than the throttle valve opening, so that a violent rush of steam is prevented. By this means the pressure upon the surface of the superheated water is kept approximately uniform, and it is claimed that all sudden explosions of any dangerous quantity of water into steam and consequent striking blows are avoided.

On the 16th of June, 1881, Mr. Lawson, at Munhall, near Pittsburgh, Pa., publicly tested his theory, and exploded a boiler of the ordinary style having a tensile strength of 768 lbs., at a pressure of but 290 lbs., being 478 lbs. less than the actual strength of the iron.

The experiment was made by suddenly discharging a considerable quantity of steam at 290 lbs. from the boiler into a closed cylinder, the explosion occurring at the instant the cylinder was filled.

In March, 1882, he made further experiments at the same place under the inspection of a commission of the U. S. Engineers, appointed by the Secretary of the Treasury, and fully tested a boiler with his invention attached.

The boiler, having the Lawson diaphragm and being 30 inches in diameter, with only 18 inches of water, running down to 11 inches, 4 inches below the fire line, stood every test of rapid escape and sudden check of steam up to a pressure of 300 lbs., without the slightest injury. The same boiler, with the center of the diaphragm removed, reducing it to the ordinary style boiler, with 22 inches of water, 7 inches above the fire line, was exploded at a pressure of only 235 lbs.—or 65 lbs. less than the same boiler had withstood with Lawson's device, under precisely the same circumstances, except as to the quantity of water.

In addition to the advantage of safety secured by this boiler, the owners claim that the arrangement produces dry steam and prevents foaming, the diaphragm securing uniform circulation. It is also said to prevent the forming of incrustation. Fig. 3 is an end view of the form of boiler intended for locomotive purposes. The construction of this boiler is controlled by the Lawson Non-Explosive Boiler Company, 155 Broadway, New York.

Fig. 3

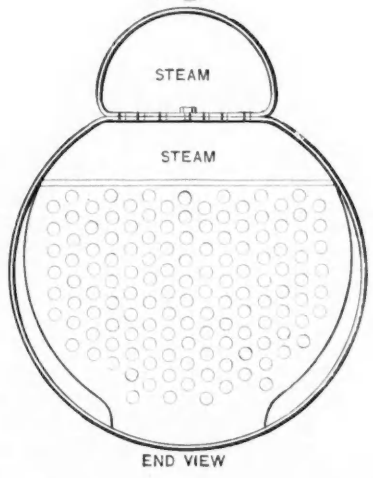
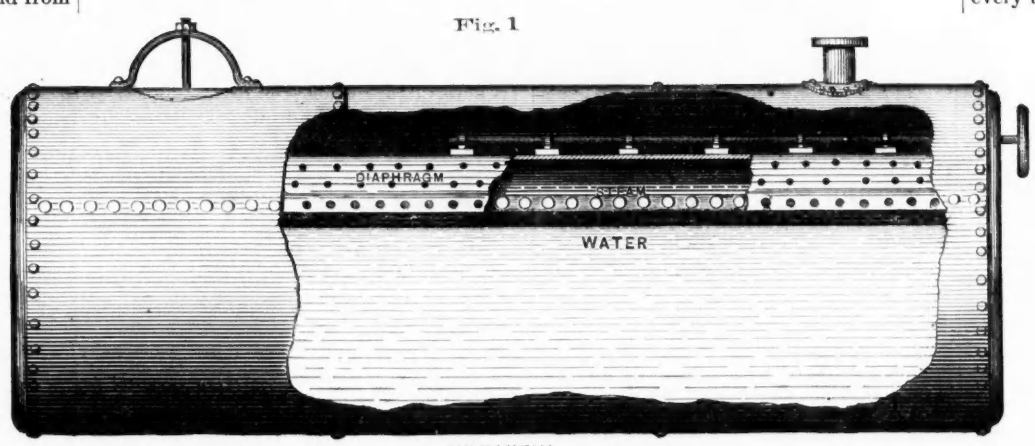


Fig. 2

Fig. 1



The Lawson Non-Explosive Boiler.

Experiments with Exhaust Nozzles.

A great many railroad master mechanics are making experiments to see if they cannot improve the exhaust nozzle arrangement of the ordinary locomotive. Mr. Buchanan, superintendent of motive power of the New York Central Railroad, is using a 4½-inch single nozzle in his new engine, No. 238, which we made some notes on a few weeks ago. The engine has been in service now long enough to furnish the means of fair comparison with the performance of other engines of the same class having double nozzles. In a series of trips with trains whose speed averaged thirty-six miles an hour, and having an average load of 8.66 passenger cars, the following coal expenditure was noted. Engine 312, equipped with steam air jets in fire-box and ordinary double nozzles, burned 41.23 pounds of coal to the mile; engine 313, without steam jet, and having double nozzles, burned 45.84 pounds of coal doing similar work; and engine 238, with steam jet and single nozzle, did the work with an expenditure of 37.32 pounds of coal to the mile. This last engine's performance compares favorably with the best European practice, and is the best we have got authentic account of in this country.

In connection with nozzle experiments, Mr. Blackwell, superintendent of motive power of the Norfolk and Western Railroad, writes us that he had found by experiment that an ill-shaped single exhaust nozzle had given, in one instance, over twenty pounds back pressure in the cylinder of an engine 20x24 inches.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, OCTOBER 4, 1884.

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Where to Look for Work.

The prevailing depression in the iron trade of this country has brought much distress and suffering to hundreds of families that depended on the weekly wages of men employed in various departments of the iron-working industries. Many other trades are slack, in sympathy with the iron and steel depression, and a greater proportion of workmen are idle than has been the case since the worst times that followed the financial panic of 1873. The system of natural distribution which transfers the surplus hands from overcrowded occupations to those susceptible of immediate employment, is going on, but many of the workmen who are taking part in the transition are enduring considerable hardship. The tramp is again abroad in the land, and in too many cases the honest workman, who has been thrown out of employment through no fault of his own, and who is now searching for some "brother of the earth" who will "give him leave to toil," is being classed with the worthless mendicant, and treated as such. This country keeps up excellent means of transporting cheaply the surplus population of other countries, from the seaboard to districts where their services are likely to be needed. It would be conferring great benefit upon our own citizens if arrangements were made to transport idle men cheaply from the districts where they are not wanted to those regions where labor is in demand. We think the new Bureau of Labor Statistics could be advantageously used to furnish information about where labor was wanted, and where it was in superabundance. Information of that kind would guide men in search of work to the right places to go, and would prevent much hardship that results from men groping in the dark as it were, and not knowing where to find what was almost in their grasp.

To those out of work we hear the oft-repeated advice given, "Go West;" but that recommendation ought to be supplemented by a bill of particulars. There are good farms yet to be obtained in Dakota, Nebraska, Minnesota, and other Northwestern States for the pre-empting, but it is mere cruelty to tell a moneyless iron-worker to go and turn farmer when he would starve while a crop, the product of his labor, was growing. To go successfully into work of that kind a man must have some previous training to farming, and he must have the means to buy implements, seed, and food to keep him until returns begin to come in. But while he is not in a position to turn land owner and farmer all at once, he can go into Western cities and towns to take a share of the work resulting from increasing agricultural and mining activity. A man who is willing to work, and who is not particular about selecting an occupation, will not long be idle in any town west of the Mississippi, especially in the Northwestern States. If he does not get the kind of work his previous training best adapts him for, he can generally contrive to make a comfortable living till something better turns up. The man worst adapted for the frontier towns is the specialist who will work at nothing but the occupation he has been brought up to. Waiting for an opening in his own line often proves equal to waiting for the wolf of hunger to visit his door.

Iron Workers' Wages in England.

Those free-traders who are trying to convince workmen that the tariff is a damage to them, and that wages in England have advanced during the last ten years, will do well to consider the following paragraph, which we quote from a late issue of *Martineau & Smith's Hardware Trade Journal* of Manchester. It refers to the price of puddling in the South Staffordshire iron mills:

"Within the last sixteen years wages have been reduced and advanced twenty-five times. The highest rate was that paid in April, 1873, which was 13s. 3d. a ton; and the lowest is the present one of 7s. 3d. Although it is necessary to explain that, as short weight was adopted in January, 1879, instead of long weight, the existing wages should for purposes of comparison with former years be regarded as one-fifteenth more, or 7s. 9d. per ton. The reductions from the highest to the lowest rate amounts to 42 per cent."

Had the wages of iron workers in this country been reduced 42 per cent., or to anywhere near $1.85 a ton in the same period, we should have heard louder complaints about the tariff than any that have yet been raised. But the same paper we have quoted from continues:

"The prices of iron have been reduced in a still greater proportion."

Had it not been for our protective tariff American iron workers would either have been reduced to the same rate of wages paid in England, or to very near the same rate, or iron mills throughout the country would close, as ocean freights are and have been very low. The iron made by this low-priced labor would be thrown upon our market, and our workmen forced into a grinding competition. Low as this rate seems, however, it is by no means the lowest paid in England, as appears from a further perusal of the same article, which says that "the wages in the North of England district are only 6s. 9d. a ton." Instead of efforts being made to advance the South Staffordshire rate a movement has been started to reduce it. "If it be true," says the journal above quoted from, "that, all things considered, the North of England workmen are accepting lower wages, that is a strong *prima facie* reason for a reduction in South Staffordshire, where masters are already heavily handicapped in the race of trade competition by reason of the facilities of shipment the northern ironmasters possess as compared with the heavy inland freights that oppress South Staffordshire."

Were our protective tariff removed both American workmen and manufacturers would be unwillingly drawn into this ruinous struggle for cheapness, and the depression in our iron manufacturing industries would be greater than ever before experienced.

Those who live and do business along navigable lakes and rivers must in time become impressed with the advisability of enforcing the use of an efficient spark arrester on steamboats. A little more than two months since a fire, originating from sparks from a boat, destroyed property in Toledo to the amount of $500,000, and recently property in Cleveland, valued at from two to three millions of dollars, was destroyed from the same cause. This may, without much straining of the point, be called wanton destruction, because so entirely preventable. The cost of the property destroyed, in the two instances noted, would have equipped a dozen times over with efficient spark arresters all the boats likely to endanger property in the cities named.

Aerial Navigation.

In the ordinary methods of transportation, a considerable amount of power is expended in overcoming various frictional resistances to the moving body. Water, although an admirable means of natural transportation, resists the movement of a ship or steamboat, and cars cannot be moved on the finest railroad track without the expenditure of considerable force to overcome axial and other resistances. The ordinary engineer accepts these calls for the exertion of force as necessities connected with the performance of work, but certain philosophers regard them as so much waste of nature's resources. Some men, holding such views, think the transportation problem ought to be solved by aerial navigation, and they have, through good and evil report, insisted that the air ship is destined to become the world's leading mode of locomotion. For a few years after the steam engine began to come into practical use, philosophers were enthusiastic in their predictions of the triumphs it would secure for aerial navigation; but thus far their hopes have been disappointed, although aeronautical science still has many hopeful votaries.

France, as a nation, has been the headquarters of the apostles of air transportation, and several mechanical discoveries and improvements have resulted from the experiments and researches connected with balloon construction. The most notable of these was the Giffard injector, which was designed in connection with efforts to reduce the weight of steam engine connections to the lowest possible limit. From accounts published in our French exchanges of recent balloon experiments successfully carried out by MM. Renard and Krebs, two military officers, with a balloon constructed at government expense, it looks as if an important advance had been made in balloon propulsion which may result in giving aeronautical investigation a great impetus among all industrial nations. With a cigar-shaped balloon 197 feet long and 39 feet diameter, they succeeded in moving at a fair speed against a wind blowing 18 feet per second, and the balloon was kept under perfect control, advancing round in different directions in obedience to its propelling and steering mechanism. The method of propulsion was an aerial helix, a light form of screw, which was placed in front of the balloon platform and revolved at high velocity by a Gramme machine, excited by the current from a battery of accumulators or voltaic cells. The balloon was steered by a sail rudder 39 feet square. On being released from the earth the balloon rose about 200 feet, then started straight in the course it was decided to travel. Having gone several miles, it was readily turned by the rudder and steered back to the starting point. When within 20 feet of the ground the propelling machine was eased, reversed, stopped, and started with about the same facility as the engines of a ferryboat are operated. The trip lasted only 40 minutes, but the electric accumulators were said to hold sufficient energy to transmit 10 horse-power for four hours. This is a method of applying power for which electrical machines are particularly well adapted.

The *Financial Chronicle* publishes a table of railway earnings of fifty-four roads for the month of August 1883 and 1884, also of the same roads for the first eight months of each year. These roads comprise over one-third of the railroad mileage of the country, embracing some of the longest lines operated by a single company as well as some short lines. The table shows that for the whole eight months 25 roads have earned less than last year, and 29 roads have earned more. Those gaining in some instances have done so at a remarkable rate. The Rochester and Pittsburgh gains 117 per cent. with an increase of track from 269 up to 294 miles. The St. Louis, Ft. Scott and Wichita, with an addition of track from 150 up to 182 miles, gains 112 per cent. in gross earnings.

The month of August alone shows a falling off in railroad business. Thirty-eight roads show a decrease and only fifteen an increase of earnings over August, 1883. The Northern Pacific, which shows 46 per cent. gain on the eight months' comparison, records a decline for the month of August notwithstanding the fact that 426 miles of new track have been added. The only very extensive railroad reporting an increase of earnings for the whole eight months, and for August as well, is the bankrupt Wabash. The fifty-four roads have added 2,400 miles of track since August, 1883. As railroad earnings indicate the general state of business, these figures are decidedly interesting.

A proceeding which a local paper mildly calls an unfortunate occurrence has recently happened in Tallahassee, Florida. The Florida Railroad and Navigation Company have repair workshops at Tallahassee, where a considerable number of machinists are employed. On the 26th of August, not having been paid their wages for July, a delegation waited on the railroad superintendent, and asked when they were going to be paid. He intimated that the pay-car would be there on September 3, but on that day no pay-car appeared, and most of the machinists concluded they would remain out till they found out if the pay-car ever would

come round. This was not a surprising decision, considering the former reputation of the road for impecuniosity. But the officials were terribly indignant at the action of the men, and when the pay-car got round a week afterwards all the machinists were discharged.

Our facetious contemporary, *Saturday Evening Chat*, of Cedar Rapids, Iowa, has come out with a new face, which appears to be well loaded with cheek, for in its first reformed issue it perpetrates this brazen joke: "The machinist is a bad, bold emissary of Satan: in his greed for gain he makes use of many vises."

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(372) F. J., Cleveland, O., says: Please inform me of a good way to temper edged tools, and also chisels for cutting iron and steel? *A.*—Information on this subject is given in the AMERICAN MACHINIST, September 8, 1883, page 6.

(373) M. C. B., Canandaigua, N. Y. writes: In a recent article on the "Fast Locomotive of the Future," the author says "The slippage of a smaller wheel is not so great as for a large one." Why is this, and what makes the difference? *A.*—The writer of the article evidently means that a small wheel has to do less slipping than a large one in going round a curve.

(374) Dummie, Pullman, Ill., says: If you take a two-foot rule in your hand and hold it with the edge that bears the divisions of the inch towards you, and the figure 1 on your left-hand, you will see that all the figures are upside down I want to know whether or not there is any reason for this? *A.*—We know of no reason. The arrangement is often awkward for those who do not measure with the left-hand.

(375) J. D. D., Danville, Ill., asks: Will you please answer the following question, to settle a dispute? How much water will a stand pipe 210 feet in height and 40" in diameter hold? I figure it from a table that says a 40" pipe, 12" long will hold 65.28 gallons, and make the pipe hold 13408.8. Is that right? *A.*—Your quotation from the table is right, and the pipe will hold 210x65.28=13708 gallons and a fraction of a gallon.

(376) J. P. G., Vineland, N. J., asks: Which will conduct heat the most rapidly, cast copper or rolled copper, and what is the difference in their conducting power? *A.*—Rolled copper is a better conductor of heat than the cast metal, but the amount of difference depends upon the relative purity of the metal. For ordinary purposes the difference in the capabilities of the two forms of copper to conduct heat will not be perceived.

(377) J. L. O., Brooklyn, N. Y., says: 1. Will you inform me how much it will cost to get a patent on a small article? *A.*—The Patent Office fee is $25, the agent's fee would depend upon the amount of work to be done. 2. Will a small article cost as much as a large one? *A.*—Yes. The Patent Office is as inconsiderate as a railroad company that charges the same fare for a small man as it does for a giant of Falstaff rotundity. 3. Can I go to Washington and obtain my own patent cheaper than by employing a lawyer? *A.*—The cheapest plan would be to employ a good patent lawyer.

(378) R. W. S., Port Jervis, N. Y., writes: A friend and I have been disputing over a question we would like you to settle. Suppose you have two locomotives, one with drivers 5 feet diameter the other with drivers 4½ feet diameter, and the other dimensions of both engines being the same, which engine will do the best work in taking a freight train over the road? *A.*—The engine with the small drivers will have the advantage in a heavy pull on a hill, but given an ordinary train, that the large-wheel engine can handle, and it will do the work with less cost of fuel than the small-wheel engine, and the cost of repairs will be less.

(379) D. B. R., Cedar Rapids, Ia., writes: 1. I have been told by very prominent master mechanics that the curve described by a crank pin of a locomotive in its forward motion of piston was different from that made during the backward stroke of the piston. In experiments made to test the matter, I found the curves alike. What is your opinion? *A.*—That the curves are alike. 2. I find in Webster's dictionary the epicycloid curve laid down as describing a hook on the generating circle, which I think is wrong. Is Webster right in terminating the epicycloid curve in a hook, or should it terminate in a point? *A.*—Webster is wrong, and the curve should terminate in a point.

(380) Link, New Orleans, La., says: In Mr. Meyers' analysis of the link motion, he speaks of the cylinder of the engine as lying on the right-hand side of the shaft. How can a person tell which is the right or left-hand side of a shaft? *A.*—Go into the cab and look towards the cylinders. The right-hand side of the engine will coincide with the right-hand of the observer.

(381) E. C. H., Woodstown, writes: Can you give me some information in regard to forming the cups for the piston of a hand-suction fire engine? I was told to get band leather, cut it the proper size and shape, soak it in water, grease both the leather and inside of pump, and then drive or force the piston and leather into the pump, and form the cup in this way. I did so, and the cup was nicely formed, but it works too hard; it will take four men to work one pump alone. Will it soon get loose enough, or is this too tight? *A.*—It will soon get loose. The valve should have been made by a die of the same size as the cylinder, and the leather should have been of the best oak leather. If it is hammered out before being pressed into shape, the likelihood of the material expanding and getting too tight is lessened.

(382) S. H. S., writes: I have a model of a steam engine 2 inches bore, 6 inches stroke, with two steam ports at both ends of cylinder, one for admission the other for exhaust. The steam ports are ⅝ inch wide, and there is a slide valve at each end of cylinder. The cylinder has a sliding motion, the steam acting upon the piston and upon the head of the cylinder at the same time, forcing the piston one way and the cylinder the other. Can you inform me how to set the valves? *A.*—There is not sufficient data regarding the valve gear given to enable us to give directions about setting the valves. We will, however, offer the opinion that our correspondent is wasting his time working on such a device. Steam engines have been made several times on the same principle and they have been uniform failures.

(383) A. G., Scranton, Pa., asks: 1. For the name of some composition or substance that will turn in a lathe to make fancy articles, such as inkstands, match safes, etc. *A.*—We believe some preparations of celluloid or of gutta percha could be used for this purpose, but it is a case where experiments should be made to find the proper material. 2. Do you know of a noiseless roller skate? *A.*—No; but we have reason to wish that all roller skates were noiseless, or that there were severe penalties against using ordinary roller skates. 3. Do you know of a firm making roller skates? *A.*—No. 4. Which, in your estimation, is most practicable and economical, a gas or steam engine to supply about 5-horse power for a printing office? *A.*—Both are equally practicable, but the relative cost will depend on the price of coal and gas in the place where the engine is to be used.

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Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

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Steam users, expecting to put in a first-class engine, from 10 to 60-horse power, will find it to their interest to send to the Straight-Line Engine Company, Syracuse, N. Y., for their new catalogue.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

D. McClure, Natchez, Miss., will erect an extensive foundry and machine shop.

It is said that a new steel plant will be built in Pittsburgh, to cost $100,000.

There is some prospect of an agricultural implement factory in Birmingham, Ala.

Diehl & Anderson, Millvale, near Pittsburgh, Pa., have built a new foundry, 60x40 feet.

H. Gantzer, 157 North May street, Chicago, will erect a three-story factory to cost $4,000.

Holmes Brothers, Galveston, Texas, are to start a foundry, machine shop, and planing mill.

The Alpena (Ala.) Iron Company propose to erect a blast furnace. They have $200,000 capital.

The Winthrop (Me.) Factory Company is about to build a new agricultural implement factory.

A company is being formed, with $30,000 capital, to build a carriage factory at Battle creek, Mich.

The leakage in the dam at Holyoke caused thirty-two mills to shut down, throwing 13,000 persons out of work.

Efforts are being made to organize a company in Buffalo, N. Y., to manufacture the Thurber steel car wheel.

The Phœnix Iron works have bought forty acres of land in Port Huron, Mich., on which to erect new buildings.

The shafting for the World's Exposition, at New Orleans will cost $25.000, and will be made by Jones & Laughlins, Pittsburgh, Pa.

The Morse Steam Trap and Machine Company are fitting up a factory at Waterbury, Conn., for the manufacture of steam traps.

The Kentucky Machine Works, Louisville, Ky., will have a new foundry, 200x100 feet, and the boiler yard will be enlarged.

An invoice of 3,500 barrels of New England rum was recently sent from Boston to Africa. The African police courts will now be busy.

Liddell & Co.'s large machine shops, covering several acres of ground, at Charlotte, N. C., will probably be completed by January 1.

The Dooley Automatic Rotary Engine Co., Louisville, Ky., finds its business increasing so much that new machinery must be added and the shops enlarged.

Efforts are being made to organize a cotton manufacturing company at Newnan, Ga, Judge Hiram Camp offering to head the list of subscribers with $5,000.

The Winchester Arms Company, of New Haven, Conn., has nearly completed an order for 20,000 "new model Hotchkiss" guns for the Chinese Government.

The Co-operative Stove Foundry, a new organization, composed of practical moulders, broke ground at Martin's Ferry, O., August 26, for their new building.

It is proposed to erect at Reading, Pa., a cotton factory which will have a capital of $300,000. More than half of the amount is said to have been already subscribed.

The mills at Putnam, Conn., have to shut down nearly half the time for the want of water. Old people say they never saw so little water in the Quinebaug river.

L. Katzenstein & Co., 169 Christopher street, New York, manufacturers of self-acting metallic packing propose to make a display at the New Orleans industrial exhibition.

Lucas Garrigues & Co. are fitting up a machine shop, foundry, and architectural iron works at Greenville, Darke county, O., and expect to be ready for business in thirty days.

Fay & Scott, Dexter, Me., have moved into their new machine shop, and work on the new foundry building is rapidly progressing. The machine shop is 80x40 feet and the foundry 80x30 feet.

The Nashville Plow Company has been organized at Nashville, Tenn., by W. D. Merryweather, W. H. Jackson, John M. Bass, William M. Duncan and others, to manufacture plows, cornshellers, etc.

It is probable that the Columbia Cotton Mill, at Southbridge, Mass., which was recently burned, will be rebuilt, the insurance companies preferring to do so instead of paying the insurance money.

The Troy *Evening Standard* says some of the large rocks forming one side of the Burden water mill were displaced slightly by the late earthquake shock. It was found necessary to brick the weakened spots.

Martin Worn, Humboldt and Siegel streets, Brooklyn, N. Y., whose furniture factory was recently struck by lightning and burned will rebuild at once. The new factory will be 150x50 feet, four stories high, and will cost $15,000.

William H. Hooper & Son, of Baltimore, large cotton manufacturers, have purchased the Mountain Island Cotton Mills, in North Carolina, for $125,000. They will enlarge mill capacity and probably spend about $75,000 for machinery.

The Cole Manufacturing Company, of Unionville, Conn., are engaged in building a large factory at Bridgeport, and as soon as completed will remove from Unionville to Bridgeport and resume the manufacture of light hardware.

The Louisville, New Orleans, and Texas Pacific Railroad Company, after some controversy about stock owned by the city of Vicksburg, Miss., has made an agreement with the authorities of that city to locate their principal shops there.

The American Steam Boiler and Machine Works, of Chicago, have just occupied the addition to their machine shop recently completed. It is 54x58 feet in size and two stories high, substantially built of brick, and contains several new machines.

McMurray & Stoughton, manufacturers of mill machinery, including the Medart pulley, are to remove from Hartford, Conn., to Holyoke. They employ forty hands, and a brick building will be erected on Appleton street for their use.—*Manufacturers' Gazette.*

We made a mistake in a recent issue, in saying that a Porter-Allen engine was running the Edison jumbo dynamo at the Philadelphia Electrical Exhibition. The previous week we had said, correctly, that the engine doing that work was of Armington & Sims' make.

The *Age of Steel* says: Mr. Aiken, of Louisville, who is under contract with the Elyton Land Company to build a foundry and machine works in Birmingham, Ala., is getting bids from lumbermen for the material for his building, and says he intends to commence work very soon.

Clem & Morse, 411 and 413 Cherry street, Philadelphia, builders of freight and passenger elevators, have favored us with one of the small, neat, and handy memorandum books for pocket use, which they have recently published. It is bound in alligator, and cover is detachable.

The Texas Pacific Railroad intend building large machine shops at some point on the line, probably at Fort Worth, where they have secured considerable land for a site. Plans have already been prepared for the shops, also plans for building a large round-house at Fort Worth, Texas.

Blain Brothers will erect a car factory at Ellaville, Fla, and have signed a contract to that effect. Bucki & Son, of Ellaville, whose large lumber mill was lately burned, it is reported, will build a new mill to saw 30,000 feet of lumber a day, in connection with the car factory.—*Baltimore Manufacturers' Record.*

Philip Doerr & Sons are about erecting a new carpet factory at the corner of Fifth street and Columbia avenue, Philadelphia. The structure will be four stories high, and of brick, on a foundation of Conshohocken stone. It is to have a frontage of forty-five feet, and will be one hundred feet in depth.—*Textile Record.*

The promoters of the scheme for establishing a lace factory at Wilkesbarre, Pa., propose to permit the work-people in the factory to become shareholders. The shares are to be placed at $100 each, and the total capital stock will be $150 000. It is understood that about one-fourth of the amount has already been subscribed.

T. R. Almond, 84 Pearl street, Brooklyn, N. Y., has issued a new illustrated descriptive catalogue of the Almond coupling, a new method of transmitting power at any angle. The coupling is working quite successfully in several establishments, and no case of failure has occurred. The catalogue also includes cuts and descriptions of the Almond turret-head tool and the Almond drill chuck.

W. F. & John Barnes, Rockford, Ill., have issued an eighty-page price-list and descriptive catalogue of their foot-power machinery, including scroll saws, formers, attachments, morticing machinery, tenoning machines, grinding and polishing machines, and lathes. They also make lathes and upright drills for power. The catalogue includes a variety of tools used with the machinery.

Charles F. Elmes, Chicago, is building two improved traction engines for agricultural purposes. They are entirely of iron and steel, and are designed for use in the Western States where coal and water are difficult to get at. They are intended for use in plowing, reaping, threshing, towing, etc., and arranged in such a way as not to throw sparks. They will, it is said, work with the highest degree of economy.—*Industrial World.*

The *Boston Commercial Bulletin* says: It is reported from Russia that the sheet-iron mills are doing a brisk home business, which is ascribed to the increased Russian tariff telling against the importation of English iron of inferior qualities. Russia sheet iron is always made 28x56 inches in size. A salesman for a New York house informs us that in a recent trip he came across a lot of American imitation sheet iron, which was sold for genuine Russian, but which measured 28x60 inches, the measure being the only thing which gave it away.

Detrick & Harvey, Baltimore, Md., will proceed at once to erect a machine shop, 100x60 feet, two stories high. It will be equipped with the best machinery, and is expected to be ready for starting up next winter. They examined many machine-shop structures, and concluded to adopt the plan followed by the Yale & Towne Manufacturing Company, Stamford, Conn. The shop will be well lighted, extra land having been secured, more than that covered by the building. This firm has improved their single post iron planer and have brought out a new heavy milling machine.

Machinists' Supplies and Iron.

NEW YORK, September 18, 1884

Business in the supply trade has been slightly more active last week than it was when our last report was made, but it is still by no means lively,

The call for steam supplies has been fair, and business in boiler makers' supplies continues depressed.

Iron.—The tone of recent reports still applies to the condition of the pig market. The demand continues moderate in volume and values without quotable change. Standard Lehigh brands rule steady, with supplies about equal to the requirements of consumers, but not excessive, and in some instances No. 1 X Foundry for immediate delivery is not easily obtained, but this only applies to such brands as Thomas, Crane, and the like, the offerings of off brands being fully equal to the demand and not being in any sense anxiously sought after. For the best makes of No. 1 X Foundry prices range from $19.50 to $20, but for other qualities $18 50 to $19 covers the range at which actual sales are made. No. 2 X Foundry is quoted $18 to $19 at tide-water, but only the best known brands sell at these prices. Grey Forge slow of sale at $16 to $17 at furnace. Southern brands continue to sell quith freely, and within the past week about 7,000 tons have been placed in New England and this vicinity.

There has been scarcely any change in the tin market during the past week. Spot supplies have been available from dealers at 18 30c. to 18.35c., cash, and 18.40c. to 18.45c., thirty days, while there have been sellers at 18.20c., but there has been very little demand or disposition for business, and the market has ruled dull, with an easier tendency, in consequence of low quotations from London. We quote for jobbing lots Banca 20½c.; Straits and Malacca 18.30c. to 18 35c., cash.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Foundry foreman, 18 years' exp., desires position. Highest references. A., BOX 10, AM. MACHINIST.

Situation wanted by mech'l draughtsman and pattern maker. Good references. K. T., AM. MACHINIST.

A reliable and competent mechanic desires a situation as superintendent or foreman. Best of references furnished, as to ability and habits. Address Box 475 Bangor, Me.

Situation wanted as master mechanic or foreman, by practical mech'l engineer, accustomed to metric measurement; capable of constructing and designing special tools and machinery, such as made use of on sewing machine, gun, or other fine work. Best references as to abilities andcharacter. L.P. Valiquet, 152 Second street, Brooklyn, E. D, N. Y.

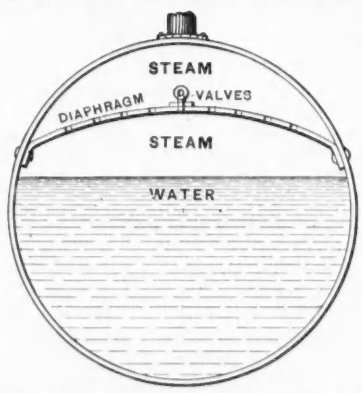
Wanted—By a thorough practical mechanical engineer, charge of machine works. Salary $2,500 per annum. 23 years' experience in firstclass works, in designing and building steam engines, shop tools, hydraulic machinery, printing presses, with extensive practice in special and general work. Good executive ability and business habits. Unexceptionable references. Address "Volens et Potens," AM. MACH.

Wanted—Second-hand tools; 24″ to 28″x15 to 18 foot bed screw-cutting engine lathe; 32″x32″x10 ft. planer; 38″ swing drill press. Address Lucas Garrigues & Co., Greenville, Darke county, Ohio.

For sale—Engine and boiler, 10-horse power; built by the New York Safety Power Company in 1880, in perfect condition, as good as new. Can be seen running, at E. B. Benjamin's, 6 Barclay street, N.Y.

Wanted—An opportunity to invest means in a machine business, after giving me a trial as draughtsman or superintendent. Can bring some paying articles in the steam engine and boiler line. Address "Engineer," care of AM. MACHINIST.

THE LAWSON NON-EXPLOSIVE BOILER



This is the only steam boiler ever devised in strict compliance with the demands of natural laws. It gives complete immunity against explosions, delivers dry steam, prevents all incrustation and deposit on the bottom plates, affords safety with high pressure, and secures great economy. The invention is applicable to every style of boiler, and can be readily applied, internally or externally, to new or old boilers. Licenses granted on liberal terms to manufacturers. Send for description.

Lawson Non-Explosive Boiler Co.,
155 & 157 BROADWAY, N. Y.

PATENTS! Thomas P. Simpson, Washington, D. C. No pay asked for patent until obtained. Write for inventor's guide.

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TOOLS & SUPPLIES.

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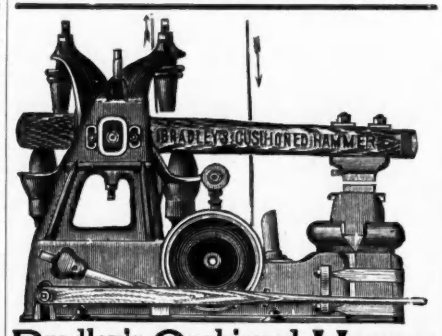

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One No. 1 Gang Drill, 4 spindle, 2 spindles geared
All Pratt & Whitney make, and just as good as new, been used three months steady.

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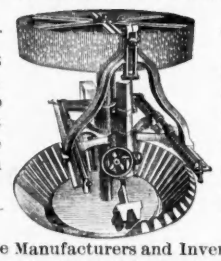

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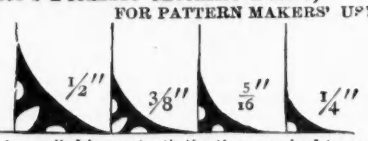
FOR PATTERN MAKERS' USE.



Can be applied in one-tenth the time required to carve curved fillets. Send for sample. H. B. Smith Machine Co., Mfrs. of Wood Working Machinery, 925 Market, Phila.

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New Pulleys at unprecedentedly low prices. Write for particulars to

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Tables of the principal speeds occurring in mechanical engineering, expressed in mètres in a second. By P. Keerayeff. Translated by Sergius Kern. Price, 20 cents. Descriptive catalogue of books, 100 pages, free.

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KNOWLES PATENT STEAM PUMPS.

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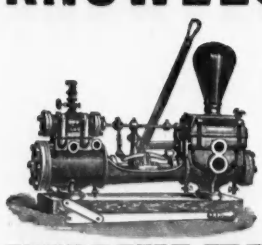

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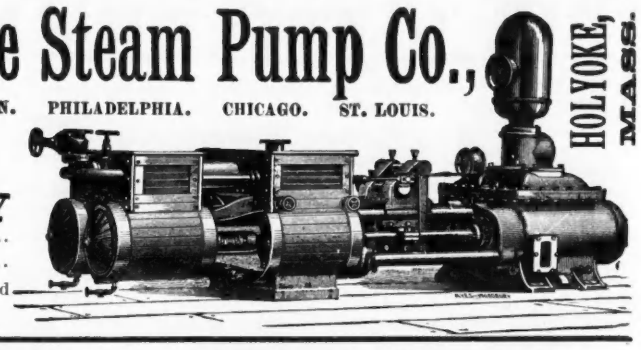

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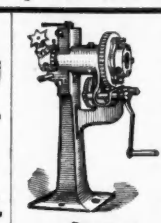

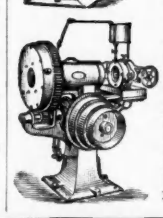

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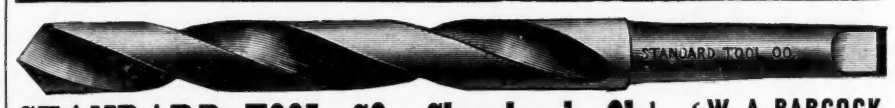

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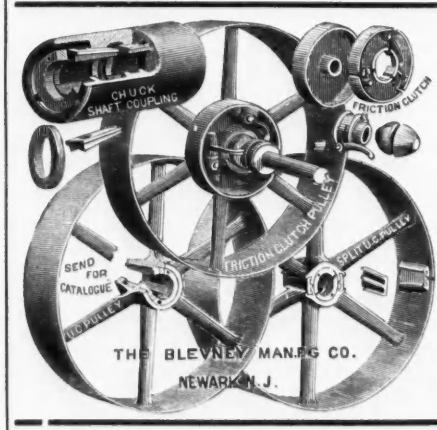

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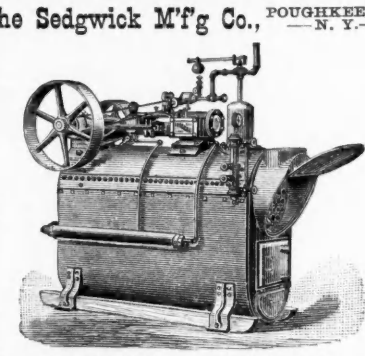

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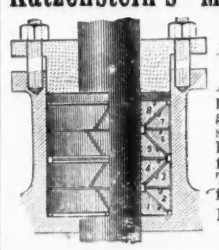

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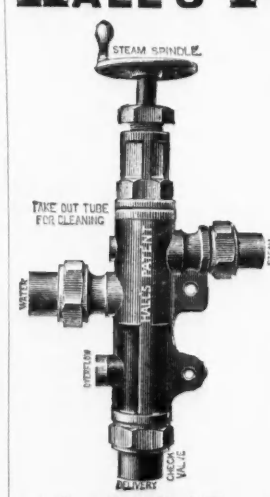

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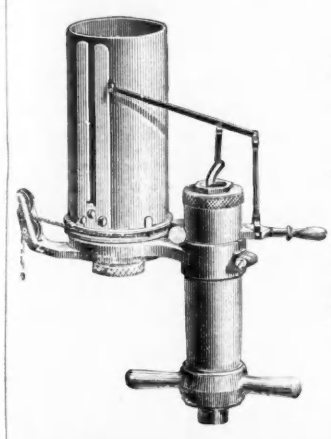

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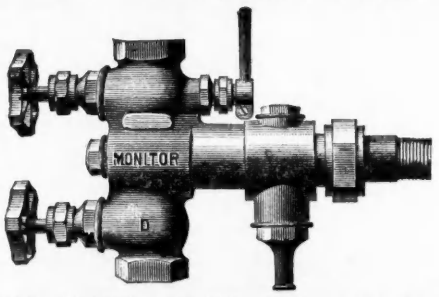

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Price lists, with references and other information, furnished on application.

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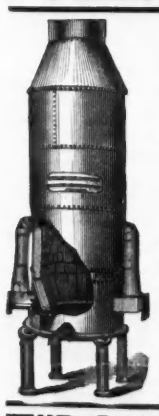

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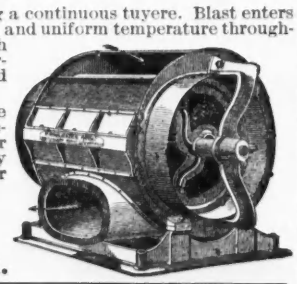

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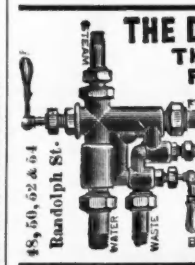

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This dog is very heavy and is warranted not to break with any work.

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" 7	1 1-8 "	.95
" 8	1 1-4 "	.95
" 9	1 3-8 "	1.10
" 10	1 1-2 "	1.10
" 11	1 3-4 "	1.25
" 12	2 "	1.40
" 13	2 1-4 "	1.60
" 14	2 1-2 "	1.60
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" 16	3 1-2 "	2.00
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Full set, 19 dogs,		25.35
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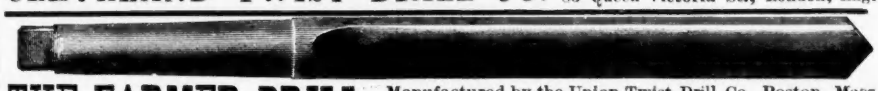

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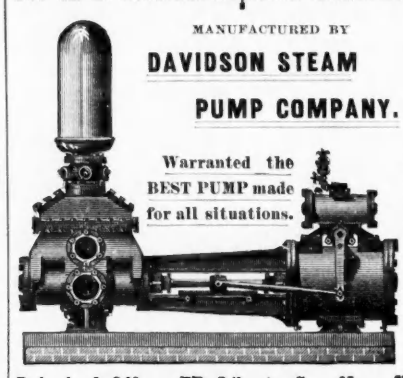

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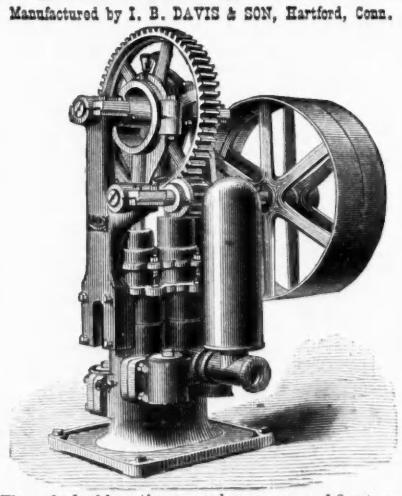

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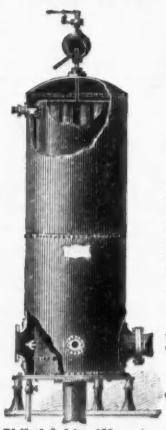

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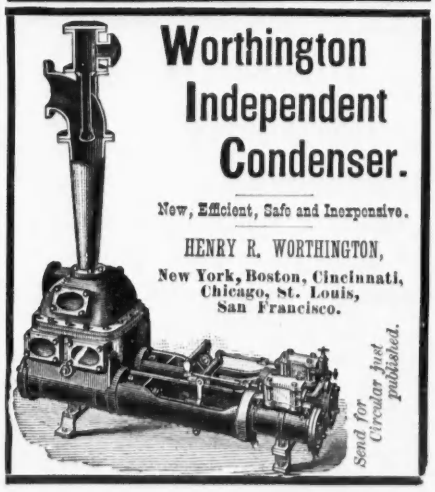

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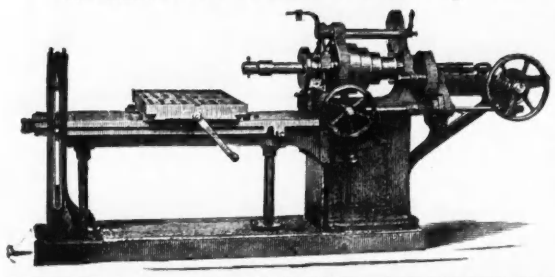

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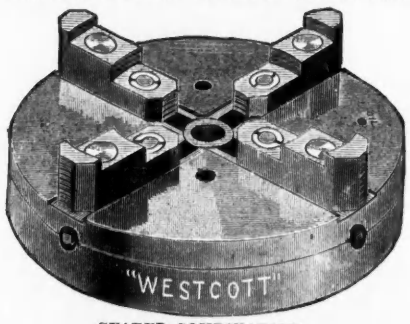

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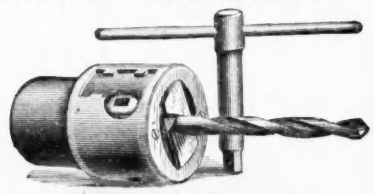

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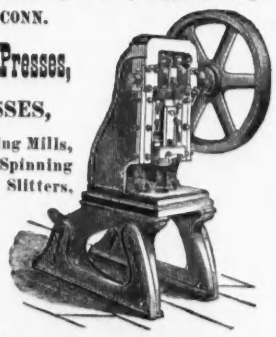

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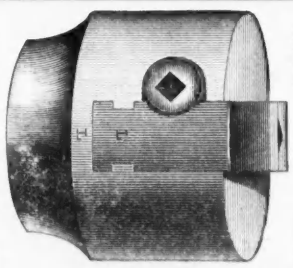

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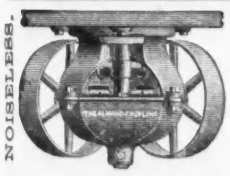

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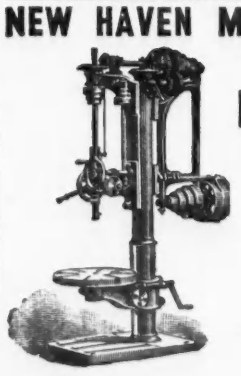

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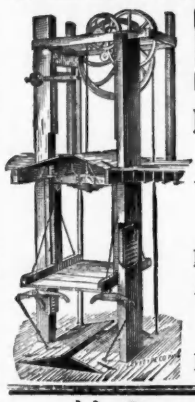

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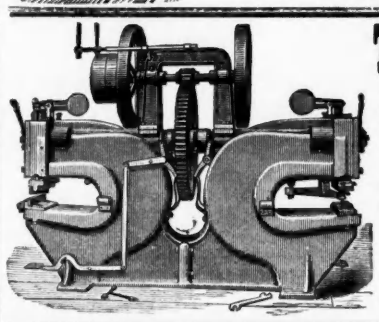

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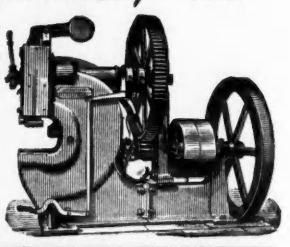

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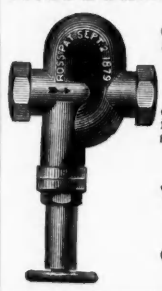

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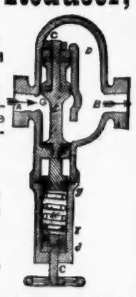

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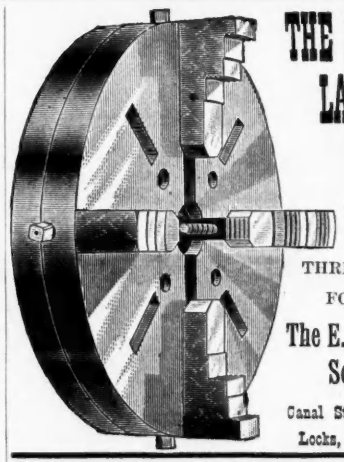

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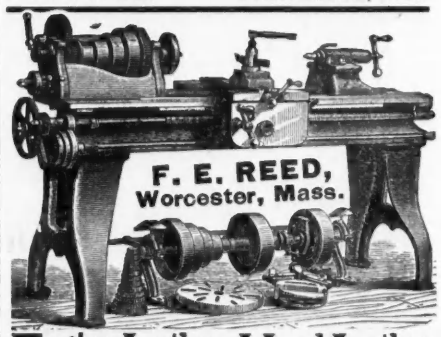

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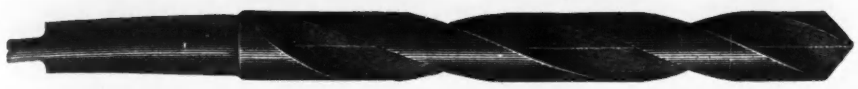

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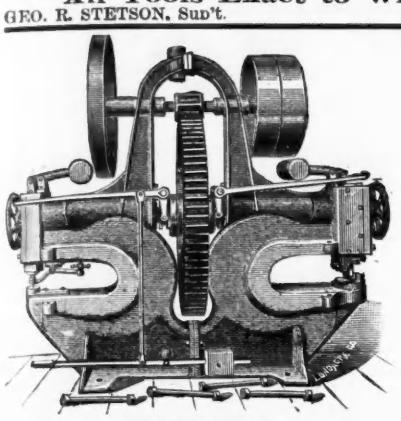

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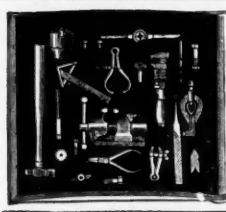

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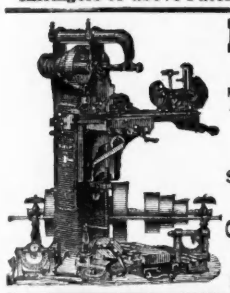

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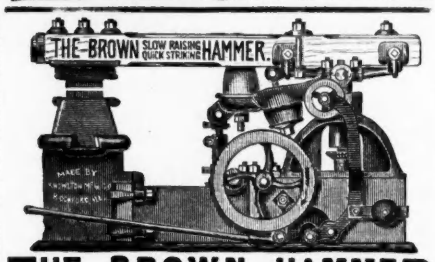

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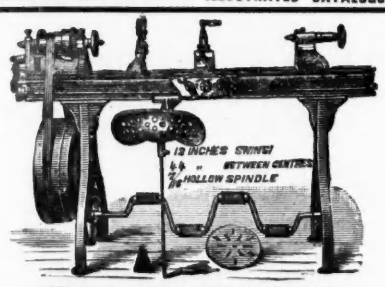

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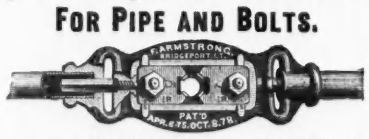

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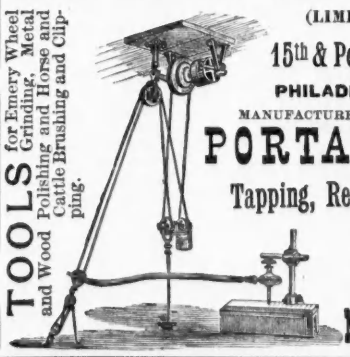

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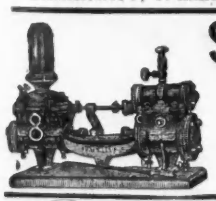

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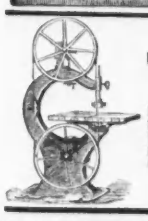

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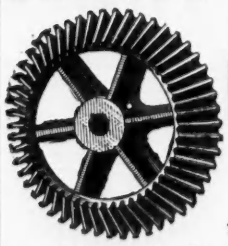

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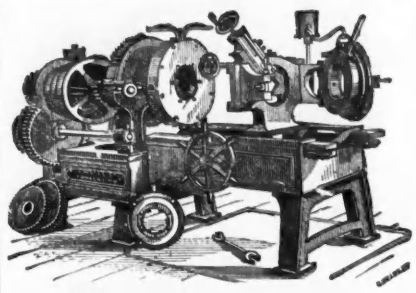

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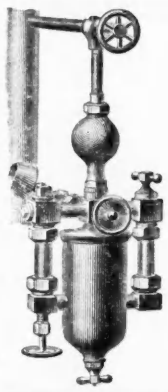

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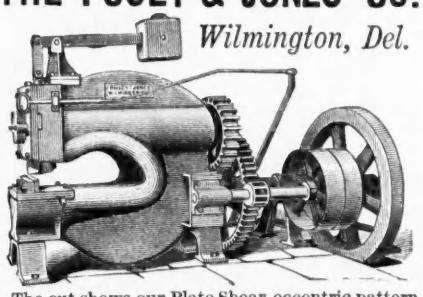

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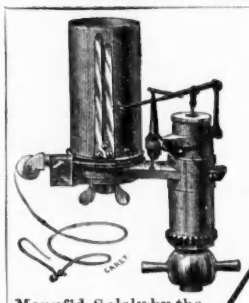

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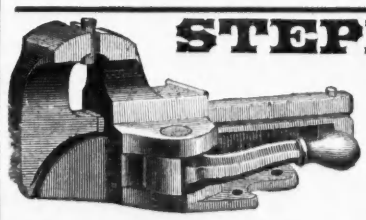

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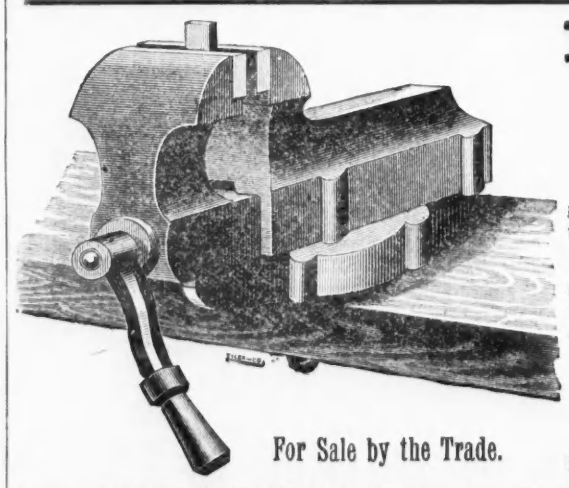

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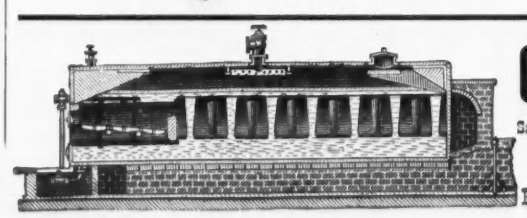

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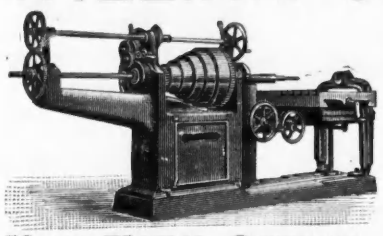

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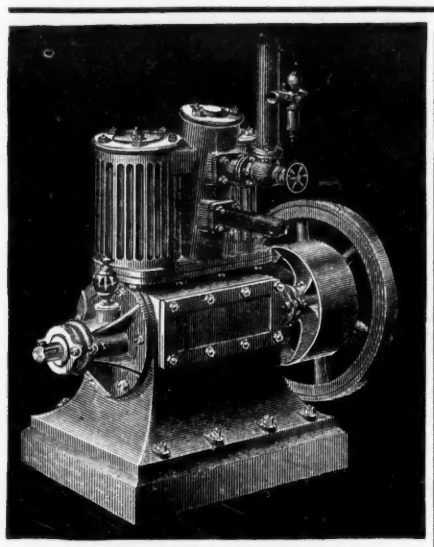

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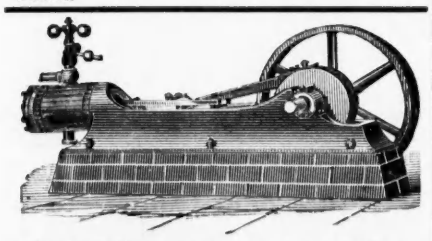

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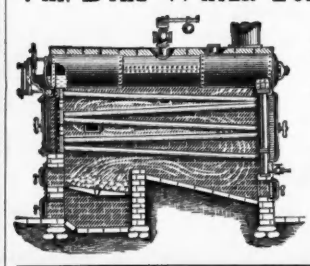

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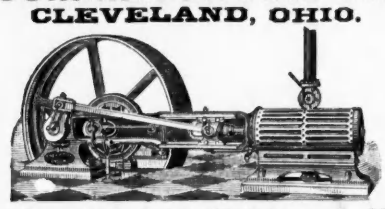

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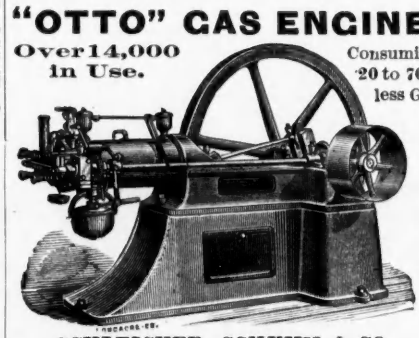

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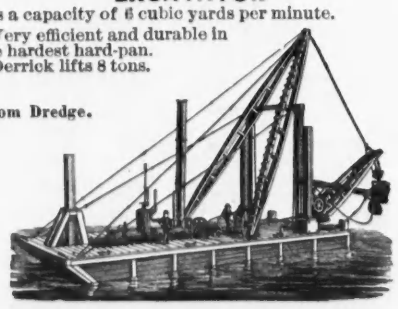

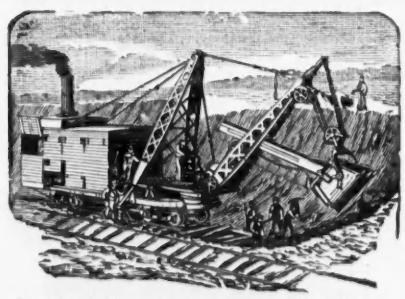

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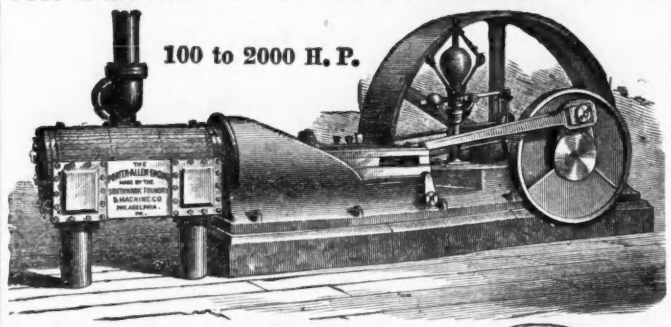

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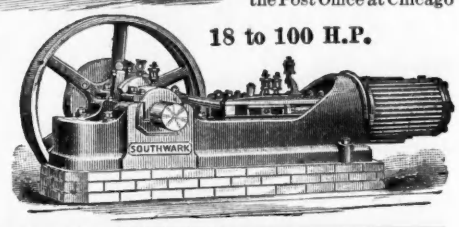

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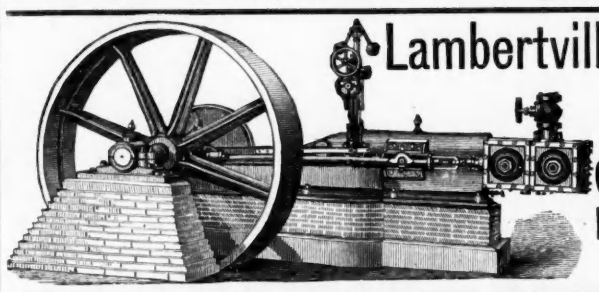

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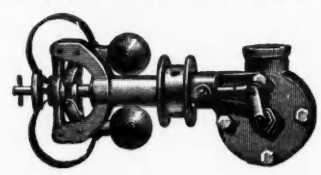

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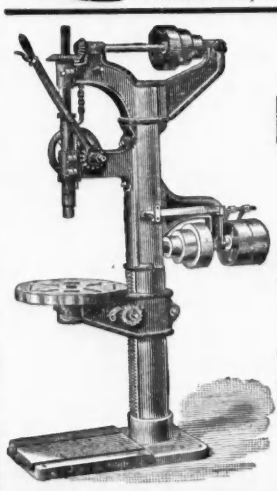

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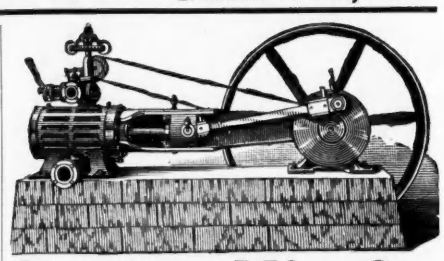

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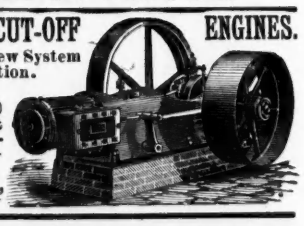

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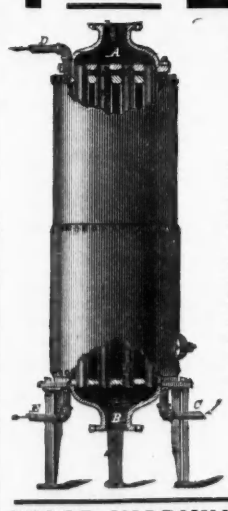

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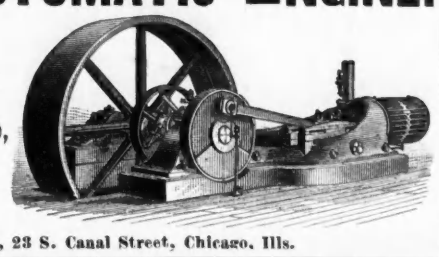

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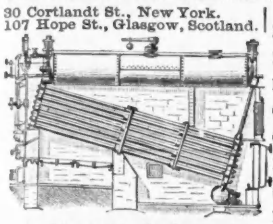

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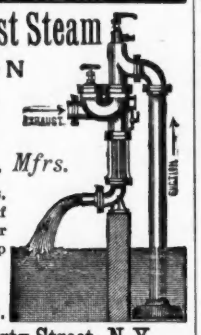

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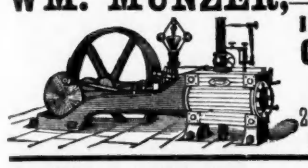

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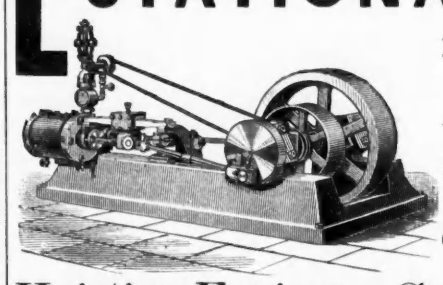

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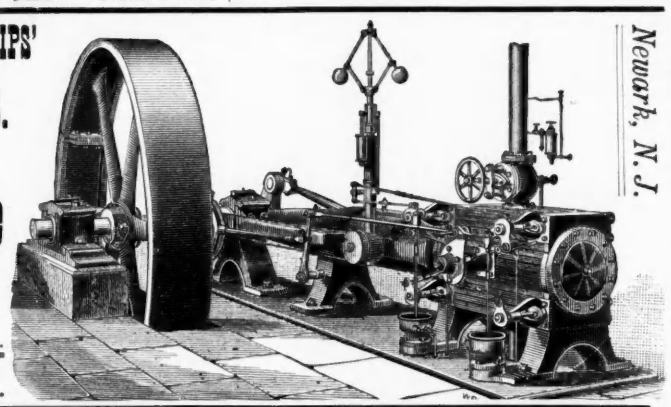

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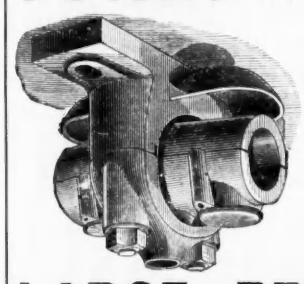

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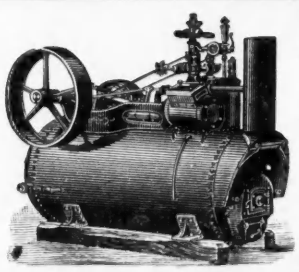

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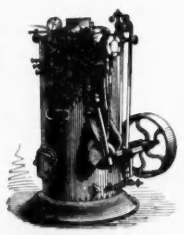

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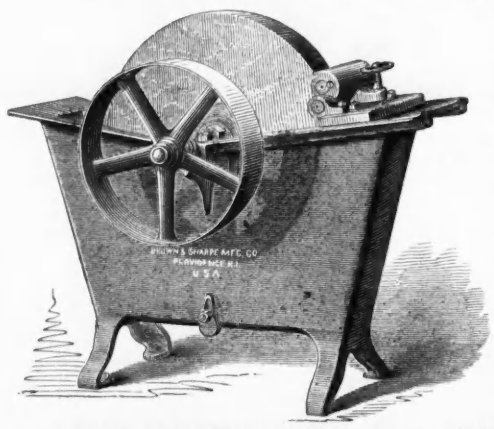

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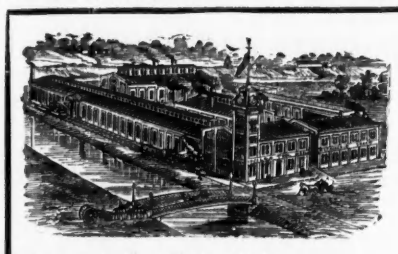

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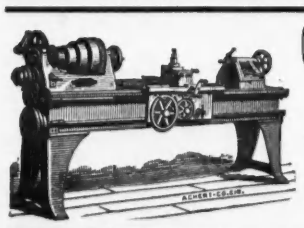

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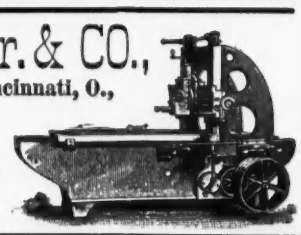

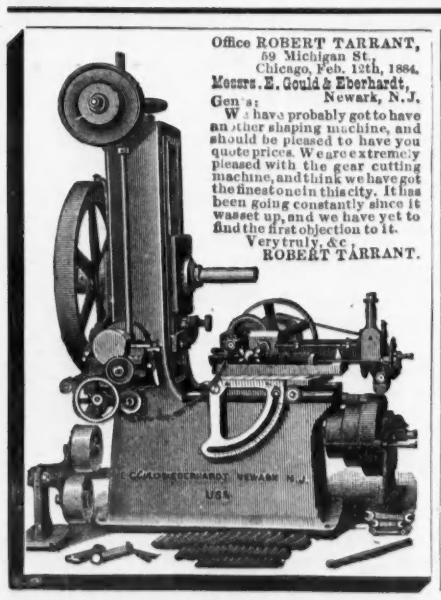

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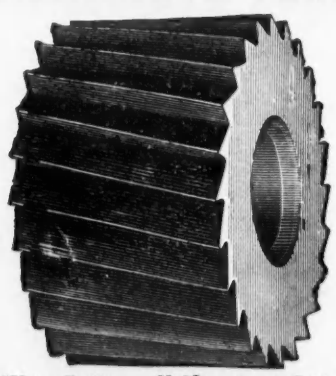

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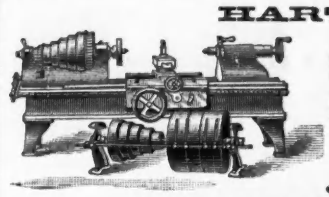

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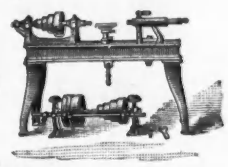

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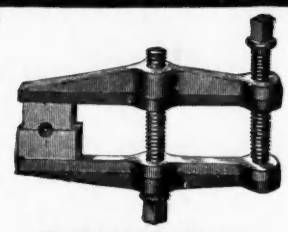

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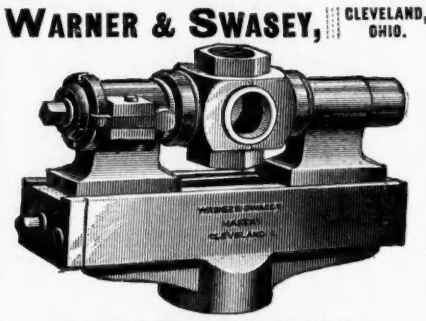

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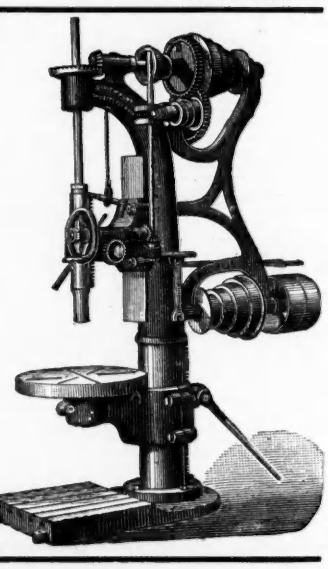

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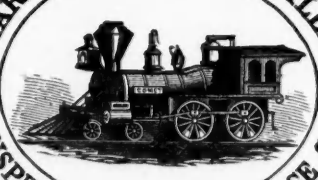

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We have the following NEW and SECOND-HAND TOOLS for immediate delivery or on short notice.

NEW.

Engine Lathes, Screw-Cutting—Three 26 in. Swing, 10, 12 and 14 ft. bed; four 24 in. Swing, 10 to 20 ft. bed; six 19 in. Swing, 6 to 12 ft. bed; six 15 in. x 6 ft. Fox Turret Lathes; six 16 in. x 6 ft. Fox Turret Lathes; six 14 in. x 5 ft. Hand-Speed Lathes; six 13 in. x 5 ft. Plain Turret Lathes; three 19 in. x 6 ft. Turret Chucking Lathes.

The above are all our own make.

SECOND-HAND.

Engine Lathes, Screw-Cutting—Three 18 in. Swing, 8 ft. bed, Lodge, Barker; two 16 in. Swing, 6 ft. bed, Ames & Perkins; one 12 in Swing, 5 ft. bed, Read; one 15 in. Swing, 5 ft. bed, B. G. Turret Lathe, Lodge, Barker.

Shapers—One 18 in. Stroke, Prentiss; one 15 in. Stroke, Hendey.

Planers—One 24 in. x 24 in. x 6 ft., Hendey; one 22 in. x 22 in. x 5 ft., Powell.

LODGE, BARKER & CO.,

N. W. CORNER EGGLESTON AVE. & 6th ST., CINCINNATI, OHIO.

MANUFACTURER OF TAPS & DIES.